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Beyond the Uruguay Round

The Implications of an Asian Free Trade Area

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There are gains from making the proposed Asia Pacific Economic Cooperation (APEC) group free trade area as broad as possible, although global liberalization remains the most favorable outcome for all countries.

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Summary findings

The Pacific Rim members of the Asia Pacific Economic Cooperation (APEC) group have different views about the role each should play in fostering further trade liberalization. But at the November 1994 APEC meetings in Bogor they committed themselves to forming an APEC free trade area. Lewis, Robinson, and Wang explore:

- The impact of such a free trade area on trade, welfare, and the economic structure of the Pacific Rim economies and the European Union.
- The implications of forming a partial free trade area, excluding such potential partners as China, the Association of Southeast Asian Nations (ASEAN) economies, or the United States.
- Whether an APEC free trade area provides more benefits than full trade liberalization that includes the European Union.

They analyze these issues using a multicountry, computable general equilibrium model to simulate alternative liberalized trade scenarios. Their findings:

Under the base-case scenario (in which all tariff and most nontariff barriers are removed among the APEC countries, China, Japan, ASEAN, the Asian newly industrializing economies [NIEs], and the United States): All APEC countries gain in GDP and the excluded European Union loses slightly. Gains are greatest for the poorer countries, for whom trade externalities are more significant. Trade expands greatly, and although there is some trade diversion away from the European Union and the rest of the world, that is swamped by the creation of trade within the free trade area. The U.S.-Japan trade balance improves only slightly (by $1.4 billion), and the U.S.-China balance worsens slightly. Movements in other bilateral balances are much larger, suggesting that changes in sectoral protection make movements in particular bilateral trade balances nearly impossible to predict.

When one economy is excluded: There are gains from making the free trade area as broad as possible. Omitting any one region (China, the United States, or the ASEAN 4) makes that region significantly worse off and lowers the gains for all other members as well. The Asian NIEs have the most to gain from broad membership. Excluding China reduces Asian NIE gains by about half, and excluding the United States yields even greater declines. Excluding the United States has the worst impact on all other potential members, greater than the effect of omitting China or the ASEAN 4. The European Union is largely unaffected by different versions of the APEC free trade area.

Global (versus regional) liberalization: Global liberalization that includes the European Union is the best outcome in terms of world GDP and welfare. And all countries gain more from global liberalization than they do from joining an APEC free trade area alone. Forming a regional free trade area may be politically easier than continued global liberalization, but there are economic incentives for all parties to expand on the completed GATT round.

This paper — a product of the Country Operations Division, East Asia and Pacific, Country Department III— is part of a larger effort to understand the policy implications for countries in the region of the current and future changes in the world trading environment. Copies of the paper are available free from the World Bank, 1818 H Street NW, Washington, DC 20433. Please contact Boonsri P. Kim, room D9-094, extension 82477 (64 pages). June 1995.

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Beyond the Uruguay Round: The Implications of an Asian Free Trade Area

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The authors acknowledge the assistance of Tom Hertel and Glenn Harrison in preparing the data used in the paper.

Abstract

The Pacific Rim members of the APEC forum have differing views about the role each should play - in fostering increased trade liberalization in the future. However, at the APEC meetings in Bogor in November 1994, commitment was made to forming an APEC free trade area (or FTA). The apparent hope is that the resulting beneficial momentum towards increasing trade liberalization and growth will outweigh the potential rise in exclusionary pressures, as members raise trade barriers against non-members, or engage in strategic behavior in order to gain individual advantage at the expense of the broader region. While rarely openly identified, these pressures are evident in East Asia in areas ranging from the debate over the proper role of APEC, negotiations concerning the pre-requisites for and timing of China's admission to the new World Trade Organization, efforts to maintain a separate role for ASEAN, and even suggestions that any Asian free trade arrangement should exclude the United States.

This paper explores three issues: (1) the impact of an APEC FTA on trade, welfare, and economic structure of the Pacific Rim economies and the European Union (EU); (2) the implications of forming a partial FTA excluding a potential partner such as China, the ASEAN economies, or the US; and (3) the relative benefits of an APEC FTA compared to full trade liberalization, including the EU.

We analyze these issues using a multi-country, computable general equilibrium (CGE) model. The model provides a simulation laboratory for doing controlled experiments, changing policy parameters and measuring the impact of the changes on the various economies and on international trade. We use the model to simulate a series of alternative liberalized trade scenarios, starting with a base case in which all tariff and most non-tariff barriers are removed among the APEC countries (US, Japan, Asian NIEs, China, and ASEAN). In order to see if there are potential strategic trade conflicts, we consider scenarios in which one economy is excluded. Finally, we consider a scenario of world trade liberalization, including the EU, to compare the benefits with those arising from regional integration.

APEC Free Trade Area: In the APEC trade liberalization scenario, we find that all APEC countries gain in GDP, while the excluded EU loses slightly. The gains are larger for the poorer countries, for whom the trade externalities are more significant. Trade expansion is quite large, and although there is some trade diversion away from the EU and the rest of the world, it is swamped by trade creation within the FTA. While the aggregate trade balance for each country is assumed to be determined by macro phenomena and is held fixed in the model, bilateral balances change significantly. However, the US-Japan trade balance improves only slightly (by $1.4 billion), while the US-China balance worsens slightly. Movements in other bilateral balances are much larger, suggesting that the changes in sectoral protection levels involved in forming an FTA make movements in particular bilateral trade balances nearly impossible to predict *a priori*.

The Effects of Excluding Countries from the APEC FTA: There are gains from making the FTA as broad as possible: omitting any one region (US, China, or ASEAN4) makes that region significantly worse off, and lowers the gains from the FTA for all other members as well. The Asian NIEs have the most to gain from broad membership. Exclusion of China reduces Asian NIE gains by about half, and exclusion of the US yields even larger declines. Exclusion of the US has the greatest negative impact on all other potential members, larger than the effect of omitting either China or ASEAN4. The EU is largely unaffected by different versions of the APEC FTA.

Regionalism versus Global Liberalization: Finally, broader world trade liberalization, including the EU along with APEC, is the best outcome in terms of world GDP and welfare. Furthermore, all countries individually gain more from global liberalization than they do from joining an APEC FTA alone. While the formation of a regional FTA may well be politically easier than achieving continued global liberalization, there are economic incentives for all parties to expand on the achievements of the completed GATT round.

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1. Introduction

The growing interest in and acceleration towards regional integration arrangements represents one of the most significant paradigmatic shifts in the international policy arena over the last several decades. Only a decade ago, the conventional wisdom was that the scope for successful regional free trade initiatives was relatively limited, with the international landscape littered with examples of efforts that had fallen short of their original lofty goals. Preliminary negotiations over the Uruguay Round were just beginning in an environment characterized by suspicion over hidden agendas and North-South confrontation. An outside observer would have found tangible progress only among the industrialized nations of the (then) European Economic Community and North America, and even there the controversy engendered by efforts to define common standards, tax, and tariff regimes might easily have suggested that these initiatives would likely suffer a bureaucratic death. Earlier regional initiatives among the developing countries (such as the Andean Pact) had collapsed, and regional organizations that achieved some success (such as ASEAN) had done so by restricting their scope to cooperation on political and security issues.

The situation of a decade ago seems like ancient history when viewed from our current vantage point. The signing and implementation of the NAFTA agreement linking the North American economies has erased the notion that free trade agreements between developing and industrial economies were unattainable. After many years of uncertainty, the successful completion of the Uruguay Round Agreement (URA) has imparted substantial forward momentum to multilateral trade liberalization. New or revitalized regional groupings are advancing ambitious agendas of regional cooperation and trade liberalization, ranging from the Mercosur and Andean Pact groups in the Western Hemisphere to ambitious expansion plans for the European Union in coming years.

Despite this progress, substantial tensions remain in several areas. While the URA represents a victory for multilateralism, the possible proliferation of regional agreements has amplified concerns over

the potential costs imposed by separation of the trading system into exclusive blocks.[1] NAFTA has set off a scramble in the Western Hemisphere among those not yet included, with nations from the Caribbean to Chile struggling with alternatives ranging from NAFTA accession to formation of separate free trade areas. In Asia, fears are expressed regarding the potential trade diversion that might occur as a result of NAFTA implementation, although most empirical estimates suggest that the losses would be small.[2]

Within East Asia, similar pressures are evident as well. The Pacific Rim members of the newly formed APEC forum have widely divergent views over the desirable role of this group in fostering trade liberalization. Some nations (such as the U.S. and Singapore) advocate free trade among APEC members by the year 2020, while others (led by China and Malaysia) argue for less ambitious objectives. Meanwhile, the evolution of APEC has forced the six ASEAN nations to reconsider the appropriate role for that group. Several years ago this group committed to plans for an ASEAN Free Trade Area (AFTA) that would reduce tariffs on most products to a maximum of 5 percent among the members by 2008: The pressure of events elsewhere recently resulted in an ASEAN decision to broaden the scope and accelerate the timetable so that major reforms would be completed by 2003 instead.

Among the factors generating pressure on Asian (and other) economies is the increasing globalization and integration of world markets, particularly as more and more regions leave behind their inward-looking policies and look outward for growth and markets. Import substitution policies and investment controls once provided insulation from international economic pressures to countries that adopted them, albeit at enormous cost. In today's climate, with massive (and somewhat fickle) foreign

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[1] Hughes Hallett and Primo Braga (1994) assess the implications of increased regionalism on progress towards a more liberal trade order, and conclude regional arrangements are unlikely to work as building blocs towards a "perfect" GATT. Instead, they argue that the best approach for developing countries threatened by the growing strength of regional arrangements is to encourage and strengthen the multilateral trade system, particularly the emerging WTO.

[2] For example, using partial equilibrium and gravity flow trade models, Primo Braga, Safadi, and Yeats (1994) estimate that total NAFTA-induced trade diversion losses could cost East Asian economies around $380-700 million, concentrated largely in sectors where high U.S. trade barriers exist. But as they point out, these losses are less than 1 percent of the gains that are expected to accrue to this region from successful implementation of the URA.

capital flows, and increasing competitive pressures in export markets, it is not enough for countries to simply make progress towards a more open trade and investment regime; exporting economies must devote equal attention to what their competitors are doing.

This situation seems particularly prevalent in East Asia. Without question, this region has benefitted enormously from rapid growth in world trade: The World Bank (1994) reports that over the last twenty-five years, the region's exports have grown by a factor of thirty, corresponding to an increase in the share of world exports from 7 to 21 percent. This report goes on to argue forcefully that East Asia should aggressively pursue liberalization at a pace faster than that promised in the URA in order to provide a locomotive to pull the world trading system towards greater openness. But running counter to this sentiment is a less optimistic perception that the ordered historical progression of export-led growth from Japan to the Asian "tigers" to the next tier has now been supplanted by a more chaotic scramble for advantage in an increasingly competitive world. The response to trade liberalization for one country in Asia depends not only on its own actions, but also on what other countries do as well. For example, the impact of China's resurgence on the region (as well as the possible costs of any renewed isolation or exclusion from the WTO), the potential competition from Vietnam, and the long-run effect of changes in the distribution or magnitude of foreign investment flows into the region were important factors behind the recent ASEAN decision to accelerate the timetable for its own free trade area.

It can be argued that concern over the policy environment in a country's economic neighbors may be beneficial, and even create momentum towards a self-fulfilling or virtuous circle of liberalization. But there is also the danger that such concerns can increase exclusionary pressures, or encourage strategic behavior that benefits the individual country but at the expense of the broader region.[3] While rarely openly identified as such, these pressures are evident in East Asia in areas ranging from the debate over

[3] For example, Hinojosa-Ojeda, Lewis, and Robinson (1994) analyze the potential for welfare-reducing "prisoner's dilemma" outcomes in an analysis of regional integration options for Central America and the Caribbean after NAFTA.

the proper role of APEC, the ongoing negotiation over the pre-requisites for and timing of China's admission to the WTO, efforts to maintain a separate role for ASEAN, and even suggestions that any Asian free trade arrangement should exclude the United States.

This paper provides an empirical assessment of two different questions related to regional integration options for the broad Asian region:

(1) What is the impact of an APEC free trade area on trade, welfare, and economic structure in the Pacific Rim economies?

(2) What are the implications of pursuing free trade initiatives when one major partner is excluded? In particular, who gains and who loses when either China, the ASEAN economies, or the US is excluded from the FTA.

(3) How do the various FTA alternatives compare with the more ambitious scenario of full world trade liberalization?

We approach these questions using a multi-country, computable general equilibrium (CGE) model to analyze the impact of trade liberalization on countries, sectors, and factors. Our APEC CGE model consists of six linked country models: US, Japan, EU, Asian NIEs (Korea, Taiwan, Singapore), China (including Hong Kong), and ASEAN4 (Indonesia, Thailand, Philippines, and Malaysia).[4] Each country model has ten sectors and two labor types, and is linked to other countries through explicit modeling of all bilateral trade flows for all traded sectors.

We use the model to simulate a series of alternative free trade scenarios, starting with a base case in which all tariff and non-tariff barriers are removed among the APEC economies (US, Japan, Asian NIEs, China, and ASEAN). We then contrast these static results with a model scenario that incorporates the notion that increased trade (or "openness") creates various externalities that directly increase

[4] Our APEC model does not include all current members of APEC, of which there are now eighteen. Excluded from our model are the industrial economies of Australia, New Zealand, and Canada, the small Pacific economies of Brunei and Papua New Guinea, and Mexico and Chile in Latin America.

productivity. Finally, we consider the implications of a free trade arrangement in which one economy (either China, ASEAN4, or the US) is left out, in order to assess quantitatively whether ASEAN4 or China gain from the exclusion of the other, and whether the Asian region is better off proceeding without the US as a partner.

The next section provides an overview of the economic structure, trade linkages, and structure of protection among countries in the APEC region, while also introducing the data used in our model. Section three introduces the conceptual tools that are needed to analyze trade liberalization and regional integration, and presents the main features of our APEC CGE model. Section four presents the alternative regional integration scenarios, and section five presents conclusions. An appendix contains a more complete description of the model.

2. Economic Structure and Trade Patterns in Major APEC Economies

Our APEC model is constructed around a six-region, ten-sector, four-factor Social Accounting Matrix estimated for the year 1992.[5] This section outlines the structure of production, demand, income, taxation and trade patterns in the base year for each economic region included in the model, and briefly describes the patterns of protection among the relevant regions. The purpose of this SAM-based data analysis is to provide an overview of the structure and linkages among the regional economies and lay the groundwork for an understanding of the simulation results reported later in this paper.[6]

Table 1 presents data on factor endowments, intensities, and costs for the regions included in the model. It reveals enormous differences in factor endowments and factor cost among these regions.

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[5] The data set is drawn primarily from the GTAP 1992 dataset, version 2, which is described in Hertel (1995). Features of this type of multi-regional SAM and aspects of its construction are described in Wang (1994).

[6] Note that for model regions that are made up of more than one national economy (ASEAN4, Asian NIEs, China, and EU), all figures on exports and imports reported in these tables (and used in the model) refer to trade with economies *outside* that region, and thus exclude trade that occurs among members of the same region. In constructing the regional data sets, this "within region" trade is netted out and treated as another source of domestic demand. Thus care must be taken in comparing trade shares and structure with other published sources on regional trade flows that do not adjust for this intra-regional trade.

Table 1: Factor Endowment, Income Shares, Factor Intensity, and Trade Dependence in APEC Model Regions

	USA	Japan	China	ASEAN4	Asian NIEs	EU
GDP and Trade Flows (billion US$):						
Exports	576.4	407.3	141.8	137.4	255.7	731.8
Imports	618.9	318.4	157.3	127.0	236.6	770.4
GDP	5899.1	3756.2	520.9	361.7	560.6	6691.4
Trade Dependence (percent):						
Export/GDP	9.8	10.8	27.2	38.0	45.6	10.9
Import/GDP	10.5	8.5	30.2	35.1	42.2	11.5
Share in World Factor Endowment (percent):						
Land	13.0	0.3	6.7	3.9	0.2	5.7
Total labor	5.1	2.6	28.8	5.6	1.2	6.4
Capital	23.6	17.8	2.0	1.2	1.8	30.1
Agri. labor	0.2	0.3	41.4	6.1	0.5	0.8
Factor Share in APEC Region Value Added (percent):						
Land	0.3	0.9	8.3	5.3	3.7	0.4
Labor	64.7	58.8	53.1	29.3	53.0	65.6
Capital	35.0	40.3	38.5	65.4	43.3	34.0
Labor Cost (thousand $):						
Average wage	27.8	31.2	0.3	0.5	3.8	27.0
Average agri. wage	14.7	17.8	0.2	0.2	3.8	19.5
Average non-agri. wage	28.1	32.0	0.6	0.7	3.8	27.4
Capital Return (percent):						
Average capital rental	11.8	11.2	11.4	24.9	17.3	10.6
Factor Proportions:						
Agri. labor/total labor (percent)	2.1	5.8	66.6	39.1	8.2	5.5
Capital/labor ratio ($000/worker)	127.7	190.6	2.0	4.7	18.1	132.0
Rental/wage ratio (percent/$000)	0.4	0.4	36.4	47.7	4.5	0.4

Source: APEC model database

ASEAN4 and China, as low-income developing countries, are poorly endowed with capital relative to labor. They have the lowest capital-labor ratios, the largest share of agriculture labor in the total labor force (half of their labor force is in agriculture), and the highest rental-wage ratio. The reverse is true for Japan, the European Union, and the United States. The Asian NIEs fall somewhere between the advanced industrial countries and the poorer Asian developing countries. Their agricultural labor share is larger than that of the industrial economies, but is much smaller than that in China and ASEAN4.

Compared to Japan, the European Community, and the United States, they have a lower capital intensity and a higher relative capital-labor price.

Table 2: Sectoral Export and Import Shares in World Trade
(Percent)

	USA	Japan	China	ASEAN4	Asian NIEs	EU	ROW	Total
Shares in World Exports:								
Grains	54.8	0.0	7.5	5.2	0.2	11.0	21.3	100.0
Other Agriculture	21.4	0.6	6.0	10.6	3.7	9.6	48.1	100.0
Forestry & Fishery	16.9	1.9	4.7	16.6	8.7	5.4	45.7	100.0
Energy & Minerals	4.0	0.4	2.4	7.6	0.3	6.2	79.2	100.0
Food Processing	19.7	1.4	4.0	9.0	4.7	29.6	31.7	100.0
Textile & Apparel	8.2	9.7	19.2	8.1	17.0	17.7	20.2	100.0
Wood & Paper	18.9	3.0	2.4	8.0	5.1	17.4	45.2	100.0
Basic Intermediates	17.3	10.2	2.6	2.4	8.6	27.9	31.0	100.0
Machinery & Equipment	22.8	23.7	2.6	2.9	9.4	23.4	15.2	100.0
Services	17.9	8.8	2.8	2.5	5.9	27.5	34.6	100.0
Total	17.9	12.7	4.4	4.3	7.9	22.7	30.1	100.0
	USA	Japan	China	ASEAN4	Asian NIEs	EU	ROW	Total
Shares in World Imports:								
Grains	2.6	19.2	10.2	6.0	11.0	5.9	45.1	100.0
Other Agriculture	14.3	13.7	4.8	3.9	9.4	37.1	16.8	100.0
Forestry & Fishery	14.9	42.9	4.0	3.7	6.4	22.1	6.0	100.0
Energy & Minerals	22.1	20.8	2.3	2.7	9.2	36.2	6.8	100.0
Food Processing	15.1	16.5	5.2	3.3	6.2	22.4	31.3	100.0
Textile & Apparel	26.7	7.5	7.1	2.7	5.1	26.4	24.5	100.0
Wood & Paper	20.6	9.6	4.1	2.3	5.3	33.2	25.0	100.0
Basic Intermediates	17.1	8.5	6.9	6.7	10.0	20.7	30.1	100.0
Machinery & Equipment	23.6	4.3	5.5	5.4	8.3	19.9	33.0	100.0
Services	12.5	12.9	3.0	1.9	5.4	24.8	39.5	100.0
Total	19.2	9.9	4.9	3.9	7.4	23.9	30.8	100.0

Note: Calculated from APEC model data base.

Since one focus of the model is on international trade flows, it is useful to present the trade structure in some detail. International trade theory generally identifies two different types of international trade. Trade among developed industrial countries with similar endowments and technology has been increasingly characterized as "intra-industry,"[7] whereas trade between high and low-income economies that have different factor endowments and technological processes is still on an inter-industry basis. The tremendous range in factor endowments and level of economic development among our model economies suggest that perhaps the traditional Heckscher-Ohlin arguments (based on different factor endowments) may explain trade among them to a large extent.

[7] "Intra-industry" in this context refers to the two-way trade between industries which produce commodities that are similar in input requirements and highly substitutable in use, such as similar televisions manufactured by different producers.

Table 2 presents the share of each region's exports and imports in total world trade from the base data used in the model. Aggregation of individual economies into regions for use in the model involved netting out trade among the combined economies, so that these data will not match data from other statistical sources on world trade volumes.[8] Overall, trade among the APEC regions in the model accounts for 70 percent of the total trade, with the rest of the world representing the rest.

Table 3 summarizes information on the sectoral structure of each region economy. Data are reported for base-year sectoral shares of output (column 1), value added (2), final demand (3), imports (4) and exports (5). Columns 6-7 show the share of exports in output and the share of imports in demand. Columns 8-11 describe the functional income distribution for each sector.

These data clearly delineate differences in structure and international comparative advantage among ASEAN4, China, the Asian NIEs, and industrial countries such as Japan, the United States, and the European Union. ASEAN4 and China are more primary-intensive than the industrial countries, and their manufacturing sectors, especially the labor-intensive textile and apparel products, are relatively larger than in the advanced countries because of a smaller service sector. Japan, the European Union, and the United States are dominated by a large service sector with a much smaller labor-intensive manufacturing sector. Again, the Asia NIEs lie between China and ASEAN4 and the industrial countries.

Trade shares are also consistent with intuition about each region's international comparative advantage. For example, a labor-intensive industry, textile and apparel, constitutes 18 percent of ASEAN4 and 42 percent of China's total exports, while machinery and equipment, which is capital and technology-intensive, makes up about 45 and 38 percent of their total imports respectively. The reverse is true for Japan and the United States. The Asia NIEs are in between, with a lower textile export share

[8] For example, the figures for ASEAN4 exclude trade among these four economies; similarly, the rest of world figures include only trade between the rest of world and other regions in our model, not among the many countries lumped together in our rest of world aggregate.

but a much higher machinery export share than China and ASEAN4, but a higher textile export share and a lower machinery and equipment export share than Japan and the United States.[9]

Columns 6 and 7 in Table 3 present sectoral shares of exports in gross output and imports in total demand as measures of trade dependence. Because of their geographical location and the smaller size of individual members, ASEAN4 and Asian NIEs have the highest trade dependence, especially for the capital-intensive machinery and equipment industries. Fifteen years of market-oriented economic reform have also led China to become more strongly linked with the world economy, especially in manufacturing products. In 1992, China exported more one third of its labor-intensive textile and apparel output and imported one third of its machinery and equipment from abroad. The United States and Japan, as the two largest economies in the world, are relatively more self-sufficient. However, Japan's poor natural resource base leads it to rely on other countries for nearly half of its total mineral and energy use, while it exported nearly one-fourth of its total machinery and equipment production to foreign markets. Although the United State has relatively low trade dependency, at the sectoral level it exports significant shares of its textile and capital goods output, and imports large amounts of nondurable manufactured goods (textiles and apparel), machinery and equipment, and energy and mineral products.

[9] Textiles provides an illustrative example of the point made earlier about the elimination of "intra-regional" trade during the combination of countries into our regional aggregates. If Hong Kong were included with the Asian NIEs rather than with China, then the share of textile exports *rises* in China (now excluding Hong Kong) but remains *unchanged* in the Asian NIEs (including Hong Kong). This occurs because the separation of China and Hong Kong means that the enormous export of textiles from China to Hong Kong (presumably for subsequent re-export) is counted as a Chinese export, rather than netted out as part of the consolidation of the individual country data sets.

Table 3: Structure of Production, Factor Income, Demand and Trade Patterns for Economic Regions

1992

	Sectoral Composition (percent)					Ratios (percent)		Factor Composition of Value Added (percent)			
	Output (1)	Value added (2)	Final demand (3)	Imports (4)	Exports (5)	Exports/ Output (6)	Imports/ Absorption (7)	Land (8)	Labor (9)	Capital (10)	Total (11)
The United States											
Grains	0.6	0.2	0.0	0.0	2.0	22.6	1.3	19.6	38.2	42.2	100.0
Other Agriculture	1.6	0.9	0.5	1.5	2.4	8.3	5.7	20.0	38.0	42.0	100.0
Forestry & Fishery	0.4	0.3	0.0	0.8	0.9	15.2	13.6		42.1	57.9	100.0
Energy & Minerals	2.4	2.9	0.0	8.3	1.6	3.9	18.4		25.3	74.7	100.0
Food Processing	4.4	2.4	5.2	2.7	3.8	5.0	3.8		51.0	49.0	100.0
Textile & Apparel	1.9	1.3	3.0	13.3	4.4	12.9	31.3		75.5	24.5	100.0
Wood & Paper	3.9	2.9	1.9	3.8	3.7	5.5	5.9		69.8	30.2	100.0
Basic Intermediates	8.8	5.2	4.4	11.2	12.2	7.9	7.8		69.5	30.5	100.0
Machinery & Equipment	11.0	8.6	11.2	41.0	42.4	22.1	22.2		78.4	21.6	100.0
Services	65.0	75.3	73.6	17.3	26.5	2.3	1.6		64.9	35.1	100.0
Total	100.0	100.0	100.0	100.0	100.0	5.7	6.1	0.3	64.7	35.0	100.0
Japan											
Grains	1.2	1.1	0.7	1.3	0.0	0.0	3.7	29.6	50.0	20.4	100.0
Other Agriculture	1.3	1.0	0.8	2.7	0.0	0.4	8.2	29.9	49.9	20.2	100.0
Forestry & Fishery	0.8	0.8	0.3	4.3	0.2	1.2	20.6		54.9	45.1	100.0
Energy & Minerals	0.8	0.8	0.0	15.3	0.2	1.8	48.0		46.6	53.4	100.0
Food Processing	5.9	3.5	7.9	5.8	0.4	0.4	4.3		56.6	43.4	100.0
Textile & Apparel	2.8	1.8	3.5	7.3	7.3	15.5	11.2		69.9	30.1	100.0
Wood & Paper	3.7	2.7	1.2	3.4	0.8	1.3	4.1		67.0	33.0	100.0
Basic Intermediates	10.0	7.0	2.2	10.9	10.1	5.9	4.7		47.1	52.9	100.0
Machinery & Equipment	15.6	12.3	14.7	14.3	62.5	23.3	5.1		59.1	40.9	100.0
Services	57.9	69.1	68.7	34.7	18.3	1.9	2.7		59.9	40.1	100.0
Total	100.0	100.0	100.0	100.0	100.0	5.8	4.6	0.9	58.8	40.3	100.0
China											
Grains	7.6	10.5	7.7	1.4	1.1	1.8	2.5	27.9	58.2	14.0	100.0
Other Agriculture	9.3	14.9	11.2	1.9	2.7	3.6	2.9	29.0	58.9	12.0	100.0
Forestry & Fishery	1.9	3.2	1.8	0.8	1.1	7.0	6.0		80.7	19.3	100.0
Energy & Minerals	2.7	3.7	0.4	3.4	3.9	18.3	17.3		34.4	65.6	100.0
Food Processing	5.6	3.7	8.5	3.7	3.2	7.0	8.8		24.4	75.6	100.0
Textile & Apparel	13.4	7.8	9.5	13.9	41.8	35.1	17.5		47.2	52.8	100.0
Wood & Paper	2.7	2.0	1.3	3.0	1.9	8.8	14.0		45.9	54.1	100.0
Basic Intermediates	13.0	10.4	2.7	17.9	7.4	7.0	16.6		32.5	67.5	100.0
Machinery & Equipment	12.4	8.4	15.8	37.6	19.9	19.7	32.6		43.0	57.0	100.0
Services	31.5	35.4	41.2	16.4	17.0	6.7	7.1		58.3	41.7	100.0
Total	100.0	100.0	100.0	100.0	100.0	11.9	13.3	8.3	53.1	38.5	100.0

Table 3 (continued)

	Sectoral Composition (percent)					Ratios (percent)		Factor Composition of Value Added (percent)			
	Output (1)	Value added (2)	Final demand (3)	Imports (4)	Exports (5)	Exports/ Output (6)	Imports/ Absorption (7)	Land (8)	Labor (9)	Capital (10)	Total (11)
ASEAN 4											
Grains	5.6	5.5	4.3	1.0	0.8	3.0	3.4	31.8	25.1	43.1	100.0
Other Agriculture	6.4	8.9	4.7	2.0	4.9	15.4	6.4	36.8	25.2	38.0	100.0
Forestry & Fishery	3.2	4.9	2.4	0.9	3.9	24.3	6.6		19.1	80.9	100.0
Energy & Minerals	4.9	7.9	0.1	5.1	12.9	54.0	29.3		10.2	89.8	100.0
Food Processing	8.1	5.3	9.4	2.9	7.3	18.2	7.6		23.2	76.8	100.0
Textile & Apparel	7.6	4.2	3.7	6.6	18.1	43.6	21.3		29.4	70.6	100.0
Wood & Paper	3.3	2.3	1.0	2.1	6.7	41.2	16.4		30.9	69.1	100.0
Basic Intermediates	8.5	5.5	3.4	21.5	7.1	16.6	35.2		16.6	83.4	100.0
Machinery & Equipment	7.7	4.5	15.6	45.4	22.7	60.8	64.1		28.8	71.2	100.0
Services	44.7	50.9	55.5	12.6	15.6	7.2	5.5		36.3	63.7	100.0
Total	100.0	100.0	100.0	100.0	100.0	20.0	18.8	5.3	29.3	65.4	100.0
Asian NIEs											
Grains	2.2	2.4	1.7	1.0	0.0	0.1	6.2	46.8	42.7	10.5	100.0
Other Agriculture	2.9	3.2	3.0	2.5	0.9	6.1	12.1	46.3	44.8	8.9	100.0
Forestry & Fishery	1.1	1.7	1.1	0.9	1.1	19.3	14.8		46.5	53.5	100.0
Energy & Minerals	1.3	1.8	0.5	9.1	0.2	3.6	55.2		53.1	46.9	100.0
Food Processing	6.4	4.1	10.6	3.0	2.1	6.4	8.1		51.6	48.4	100.0
Textile & Apparel	7.5	4.3	3.3	6.6	20.5	51.6	24.4		61.9	38.1	100.0
Wood & Paper	3.0	2.2	1.1	2.6	2.3	14.9	15.3		58.9	41.1	100.0
Basic Intermediates	16.9	11.0	2.4	17.2	13.6	15.7	17.6		35.7	64.3	100.0
Machinery & Equipment	17.1	10.4	15.3	37.9	39.7	45.1	40.6		58.4	41.6	100.0
Services	41.6	58.8	61.0	19.3	19.6	9.2	8.4		55.9	44.1	100.0
Total	100.0	100.0	100.0	100.0	100.0	19.3	17.8	3.7	53.0	43.3	100.0
European Union											
Grains	0.7	0.5	0.2	0.2	0.3	9.5	1.8	10.6	67.7	21.7	100.0
Other Agriculture	2.7	1.8	0.9	3.1	0.8	2.5	7.1	11.0	68.0	20.9	100.0
Forestry & Fishery	0.4	0.4	0.2	0.9	0.2	3.7	13.6		27.0	73.0	100.0
Energy & Minerals	3.4	1.9	0.2	11.0	2.0	3.7	18.5		69.2	30.8	100.0
Food Processing	6.9	4.2	8.1	3.3	4.5	4.9	3.2		58.8	41.2	100.0
Textile & Apparel	3.3	2.3	3.8	10.6	7.5	14.7	20.1		75.7	24.3	100.0
Wood & Paper	3.6	2.5	1.9	4.9	2.7	4.9	8.9		70.7	29.3	100.0
Basic Intermediates	10.2	7.9	4.0	10.9	15.5	9.4	7.4		47.5	52.5	100.0
Machinery & Equipment	11.1	8.8	9.8	27.7	34.3	19.9	17.3		79.6	20.4	100.0
Services	57.7	69.7	70.9	27.5	32.1	3.6	3.3		65.7	34.3	100.0
Total	100.0	100.0	100.0	100.0	100.0	6.5	6.8	0.4	65.6	34.0	100.0

Table 4: Direction of Net Trade Flows Among Regions in 1992
(Billion US$)

	USA	Japan	China	ASEAN4	Asian NIEs	EU	ROW	TOTAL
The United States								
Grains	-	2.64	0.47	0.18	1.13	0.63	5.99	11.05
Other Agriculture	-	2.54	0.58	-0.40	1.99	2.78	-3.00	4.49
Forestry & Fishery	-	3.58	-0.20	-0.53	0.18	0.28	-2.67	0.63
Energy & Minerals	-	1.14	-0.40	-0.92	0.53	0.0	-42.71	-42.33
Food Processing	-	5.21	0.79	-1.25	1.09	-0.69	-0.0	5.14
Textile & Apparel	-	-5.58	-20.71	-7.27	-13.78	-2.45	-7.16	-56.95
Wood & Paper	-	2.59	-0.17	-0.61	-0.32	2.21	-5.67	-1.96
Basic Intermediates	-	0.24	1.56	1.05	4.13	-4.74	-1.35	0.89
Machinery & Equipment	-	-57.98	0.49	0.66	-8.25	15.28	40.52	-9.27
Services	-	17.18	1.43	-0.53	2.40	36.59	-11.25	45.82
Total	-	-28.42	-16.18	-9.61	-10.89	49.93	-27.31	-42.48
Japan								
Grains	-2.64	-	-0.34	-0.0	-0.0	-0.0	-1.03	-4.05
Other Agriculture	-2.54	-	-0.88	-1.11	-0.49	-0.37	-2.95	-8.34
Forestry & Fishery	-3.58	-	-0.71	-2.91	-1.67	-0.31	-3.90	-13.08
Energy & Minerals	-1.14	-	-2.03	-9.42	0.0	-0.43	-34.69	-47.65
Food Processing	-5.21	-	-0.91	-1.40	-2.64	-2.97	-3.88	-17.01
Textile & Apparel	5.58	-	-1.88	0.0	-1.40	2.79	1.41	6.55
Wood & Paper	-2.59	-	0.30	-1.72	-0.0	-0.34	-3.04	-7.47
Basic Intermediates	-0.24	-	4.67	4.06	6.99	-1.81	-7.03	6.64
Machinery & Equipment	57.98	-	18.69	16.84	28.39	40.62	46.41	208.92
Services	-17.18	-	0.33	-5.39	-2.41	-4.42	-6.60	-35.66
Total	28.42	-	17.26	-1.01	26.74	32.74	-15.31	88.84
China								
Grains	-0.47	0.34	-	0.10	0.60	-0.17	-0.97	-0.56
Other Agriculture	-0.58	0.88	-	0.0	0.33	0.80	-0.67	0.76
Forestry & Fishery	0.20	0.71	-	-0.34	-0.0	0.0	-0.39	0.22
Energy & Minerals	0.40	2.03	-	-0.62	0.85	-0.11	-2.24	0.32
Food Processing	-0.79	0.91	-	-0.29	0.11	-0.95	-0.32	-1.33
Textile & Apparel	20.71	1.88	-	0.24	-7.23	13.35	8.40	37.34
Wood & Paper	0.17	-0.30	-	-1.04	-0.77	0.17	-0.22	-1.99
Basic Intermediates	-1.56	-4.67	-	0.37	-5.74	-2.48	-3.47	-17.55
Machinery & Equipment	-0.49	-18.69	-	-0.72	-8.21	-3.19	0.26	-31.03
Services	-1.43	-0.33	-	-0.65	-0.42	3.59	-2.44	-1.68
Total	16.18	-17.26	-	-2.92	-20.52	11.09	-2.07	-15.50
ASEAN 4								
Grains	-0.18	0.0	-0.10	-	0.11	0.0	-0.0	-0.17
Other Agriculture	0.40	1.11	-0.0	-	1.45	1.62	-0.33	4.23
Forestry & Fishery	0.53	2.91	0.34	-	0.38	0.24	-0.25	4.14
Energy & Minerals	0.92	9.42	0.62	-	3.47	0.0	-3.24	11.27
Food Processing	1.25	1.40	0.29	-	1.06	1.38	1.04	6.42
Textile & Apparel	7.27	-0.0	-0.24	-	-0.36	5.71	4.19	16.51
Wood & Paper	0.61	1.72	1.04	-	1.32	1.55	0.34	6.58
Basic Intermediates	-1.05	-4.06	-0.37	-	-5.88	-2.37	-3.80	-17.54
Machinery & Equipment	-0.66	-16.84	0.72	-	-3.21	-5.14	-1.36	-26.49
Services	0.53	5.39	0.65	-	0.42	1.73	-3.28	5.44
Total	9.61	1.01	2.92	-	-1.25	4.84	-6.73	10.40
Asian NIEs								
Grains	-1.13	0.0	-0.60	-0.11	-	-0.0	-0.39	-2.29
Other Agriculture	-1.99	0.49	-0.33	-1.45	-	0.77	-1.09	-3.60
Forestry & Fishery	-0.18	1.67	0.0	-0.38	-	0.11	-0.52	0.74
Energy & Minerals	-0.53	-0.0	-0.85	-3.47	-	-0.13	-15.94	-20.98
Food Processing	-1.09	2.64	-0.11	-1.06	-	-1.04	-1.01	-1.67
Textile & Apparel	13.78	1.40	7.23	0.36	-	5.47	7.48	36.74
Wood & Paper	0.32	0.0	0.77	-1.32	-	0.20	-0.30	-0.26
Basic Intermediates	-4.13	-6.99	5.74	5.88	-	-3.62	-2.67	-5.77
Machinery & Equipment	8.25	-28.39	8.21	3.21	-	6.07	14.51	11.85
Services	-2.40	2.41	0.42	-0.42	-	6.08	-1.72	4.36
Total	10.89	-26.74	20.52	1.25	-	14.85	-1.65	19.12
European Union								
Grains	-0.63	0.0	0.17	-0.0	0.0	-	1.48	1.06
Other Agriculture	-2.78	0.37	-0.80	-1.62	-0.77	-	-11.87	-17.46
Forestry & Fishery	-0.28	0.31	-0.0	-0.24	-0.11	-	-4.94	-5.33
Energy & Minerals	-0.0	0.43	0.11	-0.0	0.13	-	-70.78	-70.22
Food Processing	0.69	2.97	0.95	-1.38	1.04	-	3.82	8.09
Textile & Apparel	2.45	-2.79	-13.35	-5.71	-6.47	-	-0.90	-26.76
Wood & Paper	-2.21	0.34	-0.17	-1.55	-0.20	-	-14.24	-18.03
Basic Intermediates	4.74	1.81	2.48	2.37	3.62	-	14.44	29.46
Machinery & Equipment	-15.28	-40.62	3.19	5.14	-6.07	-	91.20	37.55
Services	-36.59	4.42	-3.59	-1.73	-6.08	-	66.60	23.03
Total	-49.93	-32.74	-11.09	-4.84	-14.85	-	74.81	-38.63

Table 4 presents data on the directions of net trade flows in the base year for the regions in the model. They show that, among the advanced countries, minerals and energy are the major import sector, while capital-intensive manufactures are generally major net export sectors, except for machinery and equipment in the United States, where there is a large deficit with Japan ($58 billion). The US is a net net exporter of agricultural and food processing products and services, the EU has a surplus in food processing, intermediates, machinery, and services, and Japan has an enormous surplus (over $200 billion) in the machinery and equipment sector, with much smaller positive balances for textiles and intermediates. China and ASEAN4 trade patterns exhibit some similarities: They are both net importers of capital-intensive manufactured products (basic intermediates, machinery and equipment), net exporters in labor-intensive manufactures and other primary products, and largely self-sufficient in food grains. The ASEAN4 trade surplus is diversified across mineral and energy products and other resource-based sector as well as in textiles and apparel. The net trade data for the Asian NIEs reveal that these economies are net exporters both of labor-intensive manufactures (like China and ASEAN4) and technology and capital-intensive machinery and equipment (like the industrial countries), and net importers of intermediates and mineral and energy products. At the aggregate level, the Asian NIEs have a trade surplus with the United States, European Union, and China, but a large trade deficit with Japan.

Tables 5 and 6 present data on the market shares of exports and imports, and on the sectoral composition of exports by destination and imports by source. It is apparent that East Asian countries have become important markets for developed countries, especially their manufactured products. The export share of the United States and European Union in the capital-intensive manufactured goods market to the Asian NIEs has exceeded their share to Japan. Asian countries have also become the largest market for manufactured intermediate exports from Japan. The data on the sectoral trade structure further show that most of the trade among the six regions included in the model is concentrated in manufactured goods, notably on labor-intensive consumer goods, basic intermediates, and machinery and equipment.

Table 5: Market Share of Exports and Imports for Economic Regions in 1992
(Percent)

	USA	Japan	China	ASEAN4	Asian NIEs	EU	ROW	TOTAL
				Exports				
The United States								
Grains	-	22.8	4.0	2.2	9.8	5.5	55.7	100.0
Other Agriculture	-	19.0	5.8	4.8	15.0	25.2	30.2	100.0
Forestry & Fishery	-	68.3	3.9	3.1	8.5	7.9	8.4	100.0
Energy & Minerals	-	14.4	3.5	1.8	6.4	36.0	37.9	100.0
Food Processing	-	24.6	4.8	2.4	6.3	19.7	42.1	100.0
Textile & Apparel	-	8.9	4.6	2.1	7.4	27.0	49.9	100.0
Wood & Paper	-	15.3	3.3	2.7	7.2	22.5	49.0	100.0
Basic Intermediates	-	10.5	5.1	3.3	11.7	21.1	48.3	100.0
Machinery & Equipment	-	8.0	3.8	4.3	9.8	25.6	48.5	100.0
Services	-	17.5	2.6	1.0	5.8	33.9	39.3	100.0
Total	-	13.0	3.7	3.0	8.7	26.6	45.1	100.0
Japan								
Grains	1.6	-	2.3	0.8	0.5	2.3	92.5	100.0
Other Agriculture	9.3	-	14.6	8.1	41.1	14.1	12.7	100.0
Forestry & Fishery	17.4	-	25.6	21.4	11.0	7.6	17.1	100.0
Energy & Minerals	22.2	-	17.1	6.7	17.9	21.5	14.6	100.0
Food Processing	14.1	-	30.2	7.6	25.7	8.6	13.8	100.0
Textile & Apparel	26.3	-	18.9	5.8	14.4	24.1	10.4	100.0
Wood & Paper	20.0	-	21.7	10.3	22.1	10.7	15.2	100.0
Basic Intermediates	17.3	-	15.0	15.6	29.4	11.4	11.2	100.0
Machinery & Equipment	30.4	-	8.1	7.9	13.7	20.2	19.6	100.0
Services	12.7	-	4.4	1.5	10.4	13.7	57.2	100.0
Total	25.3	-	9.2	7.4	14.9	18.3	24.9	100.0
China								
Grains	0.0	21.4	-	16.4	38.8	0.5	22.8	100.0
Other Agriculture	5.7	24.4	-	11.3	13.1	26.8	18.6	100.0
Forestry & Fishery	27.5	57.5	-	0.9	5.2	6.1	2.8	100.0
Energy & Minerals	13.1	39.2	-	8.2	16.9	8.6	14.0	100.0
Food Processing	6.3	30.4	-	7.4	15.7	14.4	25.8	100.0
Textile & Apparel	37.0	12.7	-	1.8	3.9	26.9	17.8	100.0
Wood & Paper	31.9	16.2	-	3.1	8.1	23.5	17.2	100.0
Basic Intermediates	19.4	14.3	-	10.9	18.7	18.2	18.5	100.0
Machinery & Equipment	31.1	6.9	-	5.2	11.7	26.2	19.0	100.0
Services	10.3	12.1	-	2.8	10.4	23.3	41.1	100.0
Total	26.6	14.1	-	4.2	9.3	23.8	22.1	100.0
ASEAN 4								
Grains	6.7	0.8	14.3	-	9.9	6.3	61.9	100.0
Other Agriculture	15.6	16.9	6.4	-	22.5	25.5	13.0	100.0
Forestry & Fishery	13.2	57.2	6.6	-	13.9	6.9	2.3	100.0
Energy & Minerals	6.2	53.6	6.1	-	20.7	2.6	10.9	100.0
Food Processing	17.6	15.1	6.2	-	14.6	21.8	24.7	100.0
Textile & Apparel	31.4	6.8	3.2	-	14.8	24.9	18.8	100.0
Wood & Paper	13.0	22.6	12.2	-	19.9	21.0	11.2	100.0
Basic Intermediates	12.8	24.2	7.9	-	27.6	11.7	15.7	100.0
Machinery & Equipment	31.6	10.3	7.0	-	26.7	17.3	7.1	100.0
Services	9.4	30.4	6.2	-	9.4	13.0	31.6	100.0
Total	19.5	22.6	6.4	-	19.0	16.2	16.3	100.0
Asian NIEs								
Grains	1.5	1.0	42.1	6.2	-	0.7	48.6	100.0
Other Agriculture	2.4	27.1	7.3	2.7	-	42.7	17.9	100.0
Forestry & Fishery	10.1	62.6	4.0	13.0	-	5.0	5.2	100.0
Energy & Minerals	10.7	17.4	15.1	27.9	-	9.0	19.8	100.0
Food Processing	5.8	57.0	11.3	7.7	-	5.0	13.2	100.0
Textile & Apparel	29.9	10.9	18.1	7.7	-	16.3	17.1	100.0
Wood & Paper	32.4	14.6	17.2	8.9	-	12.7	14.2	100.0
Basic Intermediates	11.7	14.8	22.2	24.7	-	7.2	19.4	100.0
Machinery & Equipment	31.7	6.5	11.3	11.4	-	19.4	19.6	100.0
Services	12.8	20.3	5.8	3.2	-	19.9	38.0	100.0
Total	23.8	13.3	13.2	10.7	-	16.8	22.3	100.0
European Union								
Grains	0.3	0.9	7.7	1.0	2.7	-	87.3	100.0
Other Agriculture	10.6	6.9	3.7	1.6	3.7	-	73.5	100.0
Forestry & Fishery	8.6	20.6	1.1	7.1	1.9	-	60.8	100.0
Energy & Minerals	22.9	4.4	4.1	2.7	1.3	-	64.7	100.0
Food Processing	15.2	9.4	4.8	2.4	3.9	-	64.3	100.0
Textile & Apparel	17.0	8.1	4.8	0.9	3.8	-	65.5	100.0
Wood & Paper	13.3	3.6	2.4	1.9	2.7	-	76.1	100.0
Basic Intermediates	17.3	5.7	3.9	3.1	5.4	-	64.6	100.0
Machinery & Equipment	18.9	4.3	4.2	4.2	5.4	-	63.0	100.0
Services	6.5	6.3	0.9	0.5	1.7	-	84.3	100.0
Total	14.1	5.7	3.1	2.4	3.8	-	70.9	100.0

Table 5 (continued)

	USA	Japan	China	ASEAN4	Asian NIEs	EU	ROW	TOTAL
				Imports				
The United States								
Grains	-	0.0	0.3	13.3	0.0	1.3	85.0	100.0
Other Agriculture	-	0.4	2.4	11.5	0.6	7.1	78.0	100.0
Forestry & Fishery	-	2.2	8.6	14.7	5.9	3.1	65.4	100.0
Energy & Minerals	-	0.4	1.4	2.1	0.1	6.4	89.5	100.0
Food Processing	-	1.3	1.7	10.4	1.8	29.8	55.0	100.0
Textile & Apparel	-	9.5	26.6	9.5	19.1	11.3	24.1	100.0
Wood & Paper	-	2.9	3.7	5.1	8.0	11.2	69.1	100.0
Basic Intermediates	-	10.3	2.9	1.8	5.9	28.2	50.8	100.0
Machinery & Equipment	-	30.5	3.5	3.9	12.7	18.7	30.8	100.0
Services	-	8.9	2.3	1.9	6.0	14.2	66.7	100.0
Total	-	16.7	6.1	4.3	9.8	16.7	46.4	100.0
Japan								
Grains	65.1	-	8.4	0.2	0.0	0.5	25.7	100.0
Other Agriculture	29.6	-	10.7	13.1	7.3	4.9	34.4	100.0
Forestry & Fishery	26.9	-	6.3	22.2	12.7	2.6	29.3	100.0
Energy & Minerals	2.8	-	4.5	19.5	0.2	1.3	71.7	100.0
Food Processing	29.2	-	7.4	8.2	16.4	16.7	22.0	100.0
Textile & Apparel	9.7	-	32.3	7.3	24.5	18.9	7.3	100.0
Wood & Paper	30.1	-	4.1	19.0	7.7	6.5	32.6	100.0
Basic Intermediates	21.4	-	4.4	6.9	14.9	18.8	33.7	100.0
Machinery & Equipment	42.7	-	4.2	7.0	14.4	23.8	7.9	100.0
Services	24.2	-	2.7	5.9	9.2	13.3	44.7	100.0
Total	23.5	-	6.3	9.8	10.7	13.1	36.7	100.0
China								
Grains	21.8	0.0	-	7.3	0.7	8.3	62.0	100.0
Other Agriculture	26.0	1.7	-	14.0	5.6	7.4	45.3	100.0
Forestry & Fishery	16.4	12.2	-	27.3	8.7	1.5	33.9	100.0
Energy & Minerals	6.3	3.0	-	20.4	1.8	11.2	57.3	100.0
Food Processing	18.3	8.0	-	10.7	10.3	27.4	25.3	100.0
Textile & Apparel	5.4	25.7	-	3.7	43.5	11.9	9.8	100.0
Wood & Paper	14.9	15.8	-	23.8	21.0	10.0	14.6	100.0
Basic Intermediates	12.8	22.0	-	2.8	27.5	15.6	19.3	100.0
Machinery & Equipment	15.6	34.8	-	3.7	19.4	17.8	8.6	100.0
Services	15.1	12.6	-	5.1	11.3	7.8	47.9	100.0
Total	13.7	23.7	-	5.6	21.4	14.4	21.2	100.0
ASEAN 4								
Grains	20.5	0.0	20.6	-	0.2	1.9	56.8	100.0
Other Agriculture	26.3	1.2	17.4	-	2.5	4.0	48.6	100.0
Forestry & Fishery	14.2	11.2	1.2	-	31.0	10.6	31.8	100.0
Energy & Minerals	2.6	1.0	7.2	-	2.8	6.0	80.4	100.0
Food Processing	14.4	3.2	9.1	-	11.3	22.3	39.7	100.0
Textile & Apparel	6.5	20.8	12.5	-	48.4	5.9	5.9	100.0
Wood & Paper	22.5	13.6	3.3	-	19.7	14.5	26.3	100.0
Basic Intermediates	8.4	23.5	4.2	-	31.4	12.9	19.5	100.0
Machinery & Equipment	18.2	34.8	2.5	-	20.0	18.2	6.2	100.0
Services	9.3	7.1	4.2	-	9.9	6.7	62.8	100.0
Total	13.5	23.7	4.7	-	21.5	13.7	22.9	100.0
Asian NIEs								
Grains	48.7	0.0	26.6	4.7	-	2.7	17.3	100.0
Other Agriculture	34.3	2.5	8.4	25.4	-	3.9	25.4	100.0
Forestry & Fishery	22.5	3.3	3.8	36.1	-	1.6	32.7	100.0
Energy & Minerals	2.8	0.8	4.4	16.9	-	0.9	74.3	100.0
Food Processing	20.0	5.7	10.1	21.0	-	18.6	24.5	100.0
Textile & Apparel	12.0	27.3	14.5	23.4	-	13.1	9.6	100.0
Wood & Paper	25.8	12.7	3.7	30.4	-	8.9	18.6	100.0
Basic Intermediates	20.2	29.9	4.9	6.7	-	15.1	23.2	100.0
Machinery & Equipment	26.7	39.0	3.7	9.3	-	15.2	6.0	100.0
Services	19.2	17.0	5.4	4.4	-	8.5	45.4	100.0
Total	21.1	25.7	5.5	11.0	-	11.9	24.8	100.0
European Union								
Grains	50.5	0.0	0.7	5.5	0.0	-	43.2	100.0
Other Agriculture	14.5	0.2	4.3	7.3	4.2	-	69.4	100.0
Forestry & Fishery	6.0	0.7	1.3	5.2	2.0	-	84.9	100.0
Energy & Minerals	4.0	0.2	0.6	0.5	0.0	-	94.6	100.0
Food Processing	17.3	0.5	2.6	8.7	1.1	-	69.7	100.0
Textile & Apparel	8.4	8.8	19.6	7.6	10.5	-	45.0	100.0
Wood & Paper	12.8	1.0	1.7	5.1	1.9	-	77.5	100.0
Basic Intermediates	17.7	5.6	2.3	1.4	3.0	-	70.1	100.0
Machinery & Equipment	29.3	24.1	3.4	2.5	9.2	-	31.4	100.0
Services	24.4	4.8	2.7	1.3	4.7	-	62.0	100.0
Total	19.9	9.7	4.4	2.9	5.6	-	57.6	100.0

Table 6: Sector Composition of Exports and Imports for Economic Regions in 1992 (Percent)

	USA	Japan	China	ASEAN4	Asian NIEs	EU	ROW	TOTAL
				Exports				
The United States								
Grains	-	3.5	2.2	1.5	2.3	0.4	2.5	2.0
Other Agriculture	-	3.4	3.7	3.8	4.1	2.2	1.6	2.4
Forestry & Fishery	-	4.9	1.0	1.0	0.9	0.3	0.2	0.9
Energy & Minerals	-	1.8	1.5	1.0	1.2	2.2	1.4	1.6
Food Processing	-	7.3	5.0	3.1	2.8	2.8	3.6	3.8
Textile & Apparel	-	3.0	5.4	3.1	3.8	4.4	4.9	4.4
Wood & Paper	-	4.4	3.3	3.4	3.1	3.2	4.1	3.7
Basic Intermediates	-	9.9	16.7	13.4	16.4	9.7	13.1	12.2
Machinery & Equipment	-	26.0	43.1	61.1	47.9	41.0	45.7	42.4
Services	-	35.7	18.1	8.6	17.6	33.8	23.1	26.5
Total	-	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Japan								
Grains	0.0	-	0.0	0.0	0.0	0.0	0.0	0.0
Other Agriculture	0.0	-	0.1	0.0	0.2	0.0	0.0	0.0
Forestry & Fishery	0.1	-	0.4	0.4	0.1	0.0	0.1	0.2
Energy & Minerals	0.2	-	0.4	0.2	0.3	0.3	0.1	0.2
Food Processing	0.2	-	1.3	0.4	0.7	0.2	0.2	0.4
Textile & Apparel	7.6	-	15.1	5.8	7.1	9.7	3.1	7.3
Wood & Paper	0.7	-	2.0	1.2	1.3	0.5	0.5	0.8
Basic Intermediates	6.9	-	16.6	21.4	20.0	6.3	4.6	10.1
Machinery & Equipment	75.1	-	55.3	66.7	57.6	69.2	49.3	62.5
Services	9.2	-	8.7	3.8	12.8	13.8	42.1	18.3
Total	100.0	-	100.0	100.0	100.0	100.0	100.0	100.0
China								
Grains	0.0	1.7	-	4.4	4.7	0.0	1.2	1.1
Other Agriculture	0.6	4.7	-	7.3	3.8	3.0	2.3	2.7
Forestry & Fishery	1.1	4.3	-	0.2	0.6	0.3	0.1	1.1
Energy & Minerals	1.9	10.9	-	7.8	7.2	1.4	2.5	3.9
Food Processing	0.8	6.9	-	5.6	5.4	1.9	3.7	3.2
Textile & Apparel	58.1	37.5	-	17.7	17.4	47.2	33.7	41.8
Wood & Paper	2.3	2.2	-	1.5	1.7	1.9	1.5	1.9
Basic Intermediates	5.4	7.6	-	19.4	15.0	5.7	6.2	7.4
Machinery & Equipment	23.3	9.7	-	24.6	25.1	21.8	17.1	19.9
Services	6.5	14.6	-	11.4	19.0	16.6	31.7	17.0
Total	100.0	100.0	-	100.0	100.0	100.0	100.0	100.0
ASEAN 4								
Grains	0.3	0.0	1.8	-	0.4	0.3	3.0	0.8
Other Agriculture	3.9	3.7	4.9	-	5.8	7.7	3.9	4.9
Forestry & Fishery	2.6	9.8	3.9	-	2.8	1.6	0.5	3.9
Energy & Minerals	4.1	30.5	12.2	-	14.0	2.0	8.6	12.9
Food Processing	6.6	4.9	7.1	-	5.7	9.9	11.1	7.3
Textile & Apparel	29.1	5.4	9.0	-	14.1	27.8	21.0	18.1
Wood & Paper	4.5	6.7	12.7	-	7.0	8.7	4.6	6.7
Basic Intermediates	4.7	7.6	8.8	-	10.4	5.2	6.9	7.1
Machinery & Equipment	36.7	10.4	24.6	-	32.0	24.2	10.0	22.7
Services	7.5	21.0	15.0	-	7.7	12.6	30.3	15.6
Total	100.0	100.0	100.0	-	100.0	100.0	100.0	100.0
Asian NIEs								
Grains	0.0	0.0	0.0	0.0	-	0.0	0.0	0.0
Other Agriculture	0.0	1.9	0.5	0.2	-	2.3	0.7	0.9
Forestry & Fishery	0.5	5.1	0.3	1.3	-	0.3	0.3	1.1
Energy & Minerals	0.1	0.3	0.3	0.6	-	0.1	0.2	0.2
Food Processing	0.5	8.9	1.8	1.5	-	0.6	1.2	2.1
Textile & Apparel	25.7	16.8	28.3	14.8	-	19.9	15.8	20.5
Wood & Paper	3.1	2.5	3.0	1.9	-	1.7	1.4	2.3
Basic Intermediates	6.7	15.2	22.9	31.5	-	5.9	11.9	13.6
Machinery & Equipment	52.8	19.4	34.2	42.3	-	45.9	34.9	39.7
Services	10.5	30.0	8.6	5.8	-	23.2	33.5	19.6
Total	100.0	100.0	100.0	100.0	-	100.0	100.0	100.0
European Union								
Grains	0.0	0.0	0.8	0.1	0.2	-	0.4	0.3
Other Agriculture	0.6	1.0	1.0	0.6	0.8	-	0.9	0.8
Forestry & Fishery	0.1	0.9	0.0	0.7	0.1	-	0.2	0.2
Energy & Minerals	3.2	1.5	2.6	2.2	0.7	-	1.8	2.0
Food Processing	4.9	7.5	7.1	4.7	4.6	-	4.1	4.5
Textile & Apparel	9.0	10.5	11.5	2.8	7.3	-	6.9	7.5
Wood & Paper	2.5	1.7	2.1	2.2	1.9	-	2.9	2.7
Basic Intermediates	19.0	15.7	19.4	20.2	21.8	-	14.1	15.5
Machinery & Equipment	46.0	26.0	46.6	60.4	48.6	-	30.5	34.3
Services	14.7	35.2	8.9	6.1	13.9	-	38.2	32.1
Total	100.0	100.0	100.0	100.0	100.0	-	100.0	100.0

Table 6 (continued)

	USA	Japan	China	ASEAN4	Asian NIEs	EU	ROW	TOTAL
				Imports				
The United States								
Grains	-	0.0	0.0	0.3	0.0	0.0	0.2	0.0
Other Agriculture	-	0.0	0.6	3.9	0.0	0.6	2.5	1.5
Forestry & Fishery	-	0.1	1.1	2.6	0.5	0.1	1.1	0.8
Energy & Minerals	-	0.2	1.9	4.1	0.1	3.2	16.1	8.3
Food Processing	-	0.2	0.8	6.6	0.5	4.9	3.2	2.7
Textile & Apparel	-	7.6	58.1	29.1	25.7	9.0	6.9	13.3
Wood & Paper	-	0.7	2.3	4.5	3.1	2.5	5.7	3.8
Basic Intermediates	-	6.9	5.4	4.7	6.7	19.0	12.3	11.2
Machinery & Equipment	-	75.1	23.3	36.7	52.8	46.0	27.2	41.0
Services	-	9.2	6.5	7.5	10.5	14.7	24.8	17.3
Total	-	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Japan								
Grains	3.5	-	1.7	0.0	0.0	0.0	0.9	1.3
Other Agriculture	3.4	-	4.7	3.7	1.9	1.0	2.6	2.7
Forestry & Fishery	4.9	-	4.3	9.8	5.1	0.9	3.4	4.3
Energy & Minerals	1.8	-	10.9	30.5	0.3	1.5	29.8	15.3
Food Processing	7.3	-	6.9	4.9	8.9	7.5	3.5	5.8
Textile & Apparel	3.0	-	37.5	5.4	16.8	10.5	1.5	7.3
Wood & Paper	4.4	-	2.2	6.7	2.5	1.7	3.1	3.4
Basic Intermediates	9.9	-	7.6	7.6	15.2	15.7	10.0	10.9
Machinery & Equipment	26.0	-	9.7	10.4	19.4	26.0	3.1	14.3
Services	35.7	-	14.6	21.0	30.0	35.2	42.2	34.7
Total	100.0	-	100.0	100.0	100.0	100.0	100.0	100.0
China								
Grains	2.2	0.0	-	1.8	0.0	0.8	4.0	1.4
Other Agriculture	3.7	0.1	-	4.9	0.5	1.0	4.2	1.9
Forestry & Fishery	1.0	0.4	-	3.9	0.3	0.0	1.3	0.8
Energy & Minerals	1.5	0.4	-	12.2	0.3	2.6	9.1	3.4
Food Processing	5.0	1.3	-	7.1	1.8	7.1	4.4	3.7
Textile & Apparel	5.4	15.1	-	9.0	28.3	11.5	6.5	13.9
Wood & Paper	3.3	2.0	-	12.7	3.0	2.1	2.1	3.0
Basic Intermediates	16.7	16.6	-	8.8	22.9	19.4	16.3	17.9
Machinery & Equipment	43.1	55.3	-	24.6	34.2	46.6	15.2	37.6
Services	18.1	8.7	-	15.0	8.6	8.9	37.0	16.4
Total	100.0	100.0	-	100.0	100.0	100.0	100.0	100.0
ASEAN 4								
Grains	1.5	0.0	4.4	-	0.0	0.1	2.5	1.0
Other Agriculture	3.8	0.0	7.3	-	0.2	0.6	4.1	2.0
Forestry & Fishery	1.0	0.4	0.2	-	1.3	0.7	1.3	0.9
Energy & Minerals	1.0	0.2	7.8	-	0.6	2.2	17.8	5.1
Food Processing	3.1	0.4	5.6	-	1.5	4.7	5.0	2.9
Textile & Apparel	3.1	5.8	17.7	-	14.8	2.8	1.7	6.6
Wood & Paper	3.4	1.2	1.5	-	1.9	2.2	2.4	2.1
Basic Intermediates	13.4	21.4	19.4	-	31.5	20.2	18.4	21.5
Machinery & Equipment	61.1	66.7	24.6	-	42.3	60.4	12.3	45.4
Services	8.6	3.8	11.4	-	5.8	6.1	34.6	12.6
Total	100.0	100.0	100.0	-	100.0	100.0	100.0	100.0
Asian NIEs								
Grains	2.3	0.0	4.7	0.4	-	0.2	0.7	1.0
Other Agriculture	4.1	0.2	3.8	5.8	-	0.8	2.6	2.5
Forestry & Fishery	0.9	0.1	0.6	2.8	-	0.1	1.1	0.9
Energy & Minerals	1.2	0.3	7.2	14.0	-	0.7	27.4	9.1
Food Processing	2.8	0.7	5.4	5.7	-	4.6	2.9	3.0
Textile & Apparel	3.8	7.1	17.4	14.1	-	7.3	2.6	6.6
Wood & Paper	3.1	1.3	1.7	7.0	-	1.9	1.9	2.6
Basic Intermediates	16.4	20.0	15.0	10.4	-	21.8	16.1	17.2
Machinery & Equipment	47.9	57.6	25.1	32.0	-	48.6	9.2	37.9
Services	17.6	12.8	19.0	7.7	-	13.8	35.5	19.3
Total	100.0	100.0	100.0	100.0	-	100.0	100.0	100.0
European Union								
Grains	0.4	0.0	0.0	0.3	0.0	-	0.1	0.2
Other Agriculture	2.2	0.0	3.0	7.7	2.3	-	3.7	3.1
Forestry & Fishery	0.3	0.0	0.3	1.6	0.3	-	1.4	0.9
Energy & Minerals	2.2	0.3	1.4	2.0	0.1	-	18.1	11.0
Food Processing	2.8	0.2	1.9	9.9	0.6	-	3.9	3.3
Textile & Apparel	4.4	9.7	47.2	27.8	19.9	-	8.2	10.6
Wood & Paper	3.2	0.5	1.9	8.7	1.7	-	6.6	4.9
Basic Intermediates	9.7	6.3	5.7	5.2	5.9	-	13.3	10.9
Machinery & Equipment	41.0	69.2	21.8	24.2	45.9	-	15.1	27.7
Services	33.8	13.8	16.6	12.6	23.2	-	29.6	27.5
Total	100.0	100.0	100.0	100.0	100.0	-	100.0	100.0

On the other hand, it is also apparent that China and ASEAN4 rely heavily on industrial countries as final markets for their exports, especially their natural resource-based sectors and labor-intensive nondurable manufactured products. In 1992, Japan represents the largest market for primary resource-based exports from China and ASEAN4 (forest and fishery, minerals and energy products), while the Asian NIEs and the United States are the largest market for consumer goods exports from these economies. In the meantime, China and ASEAN4 depend on industrial countries, especially Japan and the Asian NIEs as their major supplier of basic manufactured intermediates, and machinery and equipment. The Asian NIEs are also heavily dependent on the industrial countries, especially the United States, as final markets for their manufactured products, but rely more on Japan than the US to supply their intermediate and capital-intensive manufactured goods.

The United States and Japan are the world's largest importing and exporting economies, but the composition of exports and imports for them is quite different, in both bilateral trade with other Asian regions and trade with the rest of the world. For example, Japan's overall export share of manufactured goods is much higher than its import share, especially in the machinery and transportation equipment sector. The US is more balanced between manufactured imports and exports, but imports a larger of labor-intensive nondurable manufactured goods than it exports. In bilateral trade, manufactured goods account for almost 90 percent of exports from Japan to the United States, with machinery and equipment representing 75 percent alone. Exports from the United States to Japan are considerably more diversified.

Fast-growing China and ASEAN4 are emerging as major players in manufactured trade with industrial countries (importing capital and technology-intensive products, while exporting labor-intensive manufactured goods), and have similar comparative advantage in labor-intensive goods, so there inevitably will be competition for markets in the major developed economies. In 1992, ASEAN4 has a larger share in industrial economy markets than China for almost all sectors except nondurable consumer goods, while China's share in the manufactured goods market in Asian NIEs exceeds that of ASEAN4.

These trade pattern similarities suggest that trade liberalization among developing East Asia economies may induce intense competition, especially in export-oriented manufacturing sectors.

The general impression given by the data on trade and production structure is consistent with intuition about these economies based on conventional international trade theory. At one extreme, China and ASEAN4 are seen as major competitors in labor-intensive nondurable manufactured exports and an important current and future importer of capital/technology-intensive products for their industrialization program. At the other extreme, Japan, the EU and the US are seen as major suppliers of capital/technology-intensive goods and as the final market for labor-intensive consumer products. Asian NIEs are an intermediate case between the two extremes. They are important suppliers of all manufactured goods to China and ASEAN4, and growing demanders and suppliers of technology/capital-intensive products from Japan, EU and the United States, while still remaining important suppliers of labor-intensive goods to industrial countries.

All this structural information will have important implications for changes in the pattern of trade among regions induced by trade liberalization and economic integration among the economies in East Asia and the Pacific. However, this information cannot be considered in isolation since changes in trade policies and protection levels in any of the regions and sectors will have impacts on other regions and sectors. The strength of a CGE model which includes all participating regions lies in its ability to simulate the shift in trade and production patterns induced by changes in trade policy.

Most general equilibrium analyses of regional economic liberalization focus on the removal of *ad valorem* equivalent price distortions against imports that arise from existing trade barriers and other sources. This is also the primary focus of the simulations conducted in this paper. It is widely accepted that the pattern and degree of protection are important determinants the impacts of trade liberalization. The larger the initial distortion, the greater the response to a particular policy change. Before reporting on the results of model simulations, it is necessary to provide a description of the sectoral and regional

pattern of trade barriers in the multi-regional SAM. Table 7 presents *ad valorem* import protection rates for each region by sector and supplier, along with other sectoral taxes on exports and production. Note that these rates *include* the tariff equivalent of non-tariff barriers for agriculture and textiles, and anti-dumping duties for the US and EU.[10]

Because the GTAP data protection rates include non-agricultural NTBs for the US and EU, but only statutory tariff rates for Japan, the resulting protection rates suggest that the US and EU protect themselves much more heavily against Japanese products than Japan does against US and EU products. For example, US protection against Japan ranges from 5-24 percent in the industrial sectors, while the Japanese protection against US products (based only on official tariff schedules) ranges only from 2-7 percent. To compensate for this uneven coverage, we have incorporated additional information on the *ad valorem* equivalent of Japanese NTBs, drawn from estimates provided in Sazanami, Urata, and Kawai (1995). These estimates, based on unit value index comparisons, suggest sizeable non-tariff protection across a wide range of industrial products. For our purposes, we have chosen to increase reported tariff and NTB rates by one-half of the NTB equivalent calculated by these authors, resulting in the higher bilateral protection rates for Japan reported in Table 7.

The import protection rates show substantial variations among commodity groups by sector and region. The high protection rates for agriculture and food products in the EU, Japan and Asian NIEs reflect the very high non-tariff barriers maintained in these regions. The average tariff rates in other sectors (except textiles) are generally low among developed countries and Asian NIEs, especially for mineral and energy products. But higher import barriers exist in ASEAN4 for almost all sectors.

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[10] As documented by Chyc et al (1995), the protection data in the GTAP database (version 1994) include not only tariffs, but also the tariff equivalent of non-tariff barriers in the case of agriculture and textiles/wearing apparel, and the anti-dumping duties of Canada, European Union and the United States. The tariff data draw on original country submissions to the GATT for the Uruguay Round. The source for agriculture protection data is from OECD and USDA/ERS estimates of Producer and Consumer Subsidy Equivalent (PSEs and CSEs).

Table 7: Domestic Tax and Bilateral Protection Rates by Sector and Region in 1992 (Percent)

	Production tax / subsidy	Bilateral Tariff and NTB Protection							
		USA	Japan	China	ASEAN4	Asia NIE	EU	ROW	Average
The United States									
Grains	-31.3	-	7.7	3.9	4.8	3.8	4.4	6.2	5.9
Other Agriculture	-4.3	-	8.2	11.0	7.3	9.0	9.2	13.0	12.0
Forestry & Fishery	2.1	-		0.0	0.1	0.5		1.8	1.3
Energy & Minerals	7.2	-	1.0	2.1	0.6	0.2	0.6	0.6	0.6
Food Processing	4.0	-	7.1	7.0	7.4	7.1	10.3	12.9	11.3
Textile & Apparel	0.9	-	8.8	13.5	13.1	12.5	9.3	13.4	12.3
Wood & Paper	1.3	-	4.9	2.2	5.2	3.6	2.8	1.5	2.1
Basic Intermediates	3.3	-	22.2	12.6	4.8	6.0	9.0	5.9	8.6
Machinery & Equipment	1.2	-	24.0	3.7	3.6	8.3	11.1	4.3	12.1
Average (excl. services)	1.7		22.3	10.3	6.9	9.1	9.7	5.0	9.9
Japan									
Grains	-6.5	470.0	-	463.1	402.9	465.7	463.4	476.8	471.0
Other Agriculture	-24.7	87.9	-	84.9	94.3	84.9	76.2	72.7	82.4
Forestry & Fishery	2.5	3.4	-	3.2	3.1	4.9	3.9	4.2	3.8
Energy & Minerals	2.7	0.5	-	0.0	1.5	2.0	2.7	0.6	0.7
Food Processing	10.6	34.0	-	20.1	24.4	37.0	50.2	60.5	41.2
Textile & Apparel	2.5	38.2	-	55.4	53.0	55.3	56.1	51.6	53.4
Wood & Paper	1.7	2.2	-	2.6	9.6	5.2	4.0	3.8	4.5
Basic Intermediates	5.9	77.1	-	88.4	88.4	88.7	91.4	88.2	86.5
Machinery & Equipment	3.0	35.2	-	35.4	35.6	35.4	35.5	35.2	35.3
Average (excl. services)	3.5	62.7		51.9	24.7	49.8	53.0	33.4	45.1
China									
Grains	2.2	0.0		-	0.0		1.2	0.8	0.6
Other Agriculture	2.6	17.1	6.0	-	6.6	5.1	6.8	11.4	11.4
Forestry & Fishery	7.1	11.8	2.2	-	12.4	4.1	10.0	8.1	8.9
Energy & Minerals	6.8	0.7	1.2	-	2.8	7.9	1.2	7.0	5.0
Food Processing	11.0	8.3	4.5	-	24.1	7.8	6.0	14.6	10.6
Textile & Apparel	6.5	15.3	25.1	-	5.5	15.5	11.5	12.6	16.8
Wood & Paper	8.7	2.1	8.0	-	18.4	10.4	9.5	8.5	10.3
Basic Intermediates	11.8	9.2	10.6	-	10.1	8.5	13.8	8.4	9.9
Machinery & Equipment	8.3	7.8	11.7	-	10.2	9.2	24.6	13.9	13.0
Average (excl. services)	7.3	8.5	13.4		10.7	10.9	17.8	10.1	12.2
ASEAN 4									
Grains	-0.7	0.0	14.3	5.3	-	3.6	5.3	1.2	3.5
Other Agriculture	-0.3	51.8	38.0	35.3	-	39.1	32.9	43.4	43.6
Forestry & Fishery	1.3	44.5	51.3	19.5	-	52.5	56.8	33.5	45.3
Energy & Minerals	1.3	9.8	10.9	10.7	-	6.1	10.3	14.1	13.3
Food Processing	6.5	27.9	18.3	28.5	-	14.7	34.2	18.1	23.7
Textile & Apparel	1.8	26.2	33.5	34.7	-	33.6	47.5	30.9	33.9
Wood & Paper	1.2	11.2	20.1	20.7	-	17.5	13.3	14.7	15.2
Basic Intermediates	2.0	14.4	14.0	19.1	-	10.7	22.6	11.8	13.9
Machinery & Equipment	1.7	18.2	24.8	19.7	-	20.3	20.2	23.8	21.7
Average (excl. services)	1.9	19.4	23.0	22.9		19.4	22.1	17.8	20.6
Asian NIEs									
Grains	-16.1	263.4	325.0	385.7	41.7	-	30.6	82.6	247.8
Other Agriculture	-13.6	158.0	112.8	135.5	99.8	-	76.8	115.1	126.1
Forestry & Fishery	0.2	9.8	12.8	12.5	3.3	-	13.0	11.1	8.1
Energy & Minerals	0.2	2.5	1.9	2.6	2.9	-	2.7	3.1	3.0
Food Processing	13.4	24.0	16.0	15.3	7.3	-	19.7	22.5	18.0
Textile & Apparel	1.0	7.0	8.1	8.1	1.9	-	10.6	9.1	6.9
Wood & Paper	1.4	5.6	4.4	4.8	7.2	-	5.2	4.1	5.6
Basic Intermediates	1.4	6.8	8.3	7.3	6.4	-	6.7	7.3	7.3
Machinery & Equipment	1.8	10.9	9.3	6.5	1.6	-	9.6	7.9	8.9
Average (excl. services)	1.3	24.3	9.2	35.4	9.6		10.0	11.4	14.5
European Union									
Grains	-4.3	83.7	115.8	79.5	127.0	120.8	-	82.4	85.5
Other Agriculture	-28.0	58.1	57.8	57.3	58.5	58.4	-	52.6	54.3
Forestry & Fishery	-0.4	6.0	7.2	4.3	15.5	3.4	-	7.0	7.2
Energy & Minerals	0.1	3.6	0.3	3.0	0.6	0.0	-	0.3	0.4
Food Processing	0.5	11.5	9.4	16.7	13.4	12.9	-	28.9	23.9
Textile & Apparel	0.8	3.8	9.8	9.0	10.1	8.8	-	10.9	9.6
Wood & Paper	1.0	1.9	9.1	4.5	6.0	3.6	-	5.2	4.8
Basic Intermediates	1.1	14.2	16.9	13.6	8.2	9.5	-	7.9	9.7
Machinery & Equipment	1.1	4.5	19.1	8.1	6.8	9.2	-	5.7	9.0
Average (excl. services)	-1.0	8.3	17.8	10.8	13.6	10.5		9.2	10.3

Notes: *Production tax/subsidy* is levied on domestic production.
Bilateral tariff and NTB protection are the bilateral sectoral tariff and NTB-equivalents in the model.

Source: Production tax and bilateral protection data drawn from the GTAP database (version 1994), which includes tariffs and the tariff equivalent of non-tariff barriers in the case of agriculture and textiles/wearing apparel, and the anti-dumping duties of Canada, European Union and the United States [Hertel (1995)]. The rates shown for Japan have been augmented by one-half the estimated *ad valorem* equivalent of existing NTBs, calculated from data reported in Sazanami, Urata, and Kawai (1995).

Higher rates of protection also apply to individual commodity flows among some regions. For example, the United States and European Union impose higher rates on imports of manufactured intermediates, machinery and equipment from Japan, while Japan imposes higher rates on food imports from most of its trade partners and China imposes higher rate on textile for all its trade partners and on machinery and equipment on ASEAN4. However, these differentiated tariffs by source do not imply that discriminatory tariffs are applied by country. Instead, the differences emerge largely from aggregating the same disaggregated tariff schedule using import weights for each supplier; thus, if one country supplies relatively larger quantities of goods subject to higher tariffs, when this category of goods is combined, the resulting statutory tariff will be higher than for another country supplying low tariff items.

The domestic tax rates presented in the first column of Table 7 indicate that all regions except China subsidize agriculture. The subsidy in the United States is concentrated on grain production, while in EU and Japan it applies to other agricultural products as well.

3. Modeling Regional Economic Integration

In this paper, APEC-centered regional integration is analyzed through the use of a multi-country computable general equilibrium (CGE) model. Such models are designed to quantify many of the economic forces accompanying regional integration that are considered in international trade theory. The APEC CGE model we have developed is in the tradition of recent multi-country CGE models developed to analyze the impact of the Uruguay Round of GATT negotiations,[11] the impact of the North American Free Trade Agreement,[12] and more recently the implications and options for Central America and the Caribbean of NAFTA implementation [Hinojosa-Ojeda, Lewis, and Robinson (1994)]. In this section,

[11] These models, in turn, have built on multi-country models developed to analyze the impact of the Tokyo Round of GATT negotiations — in particular, the multi-country CGE model developed by Whalley (1985). Our model starts from the WALRAS model developed at the OECD to analyze the impact of the current GATT negotiations on the major OECD countries [OECD (1990)] and the RUNS model described in Goldin, Knudsen, and van der Mensbrugghe (1993).

[12] See Hinojosa-Ojeda and Robinson (1992) and Brown (1992) for a review of NAFTA CGE models.

we summarize several important analytic issues associated with analysis of free trade areas and economic integration, provide a brief review of existing empirical analyses of Asian regional integration, and give an overview of the APEC CGE model.

Assessing the Static Impact of Customs Unions and Free Trade Areas

Analysis of the consequences of preferential trading arrangements or customs unions on member and non-member countries has long been a major strand of international trade theory. Movements toward European regional integration and the emergence of other regional trading blocs has recently given this work special policy relevance. The theory of customs unions is concerned with the effects of preferential trading arrangements where member countries agree to lower their import tariffs to other members but not to the rest of the world. Free trade areas resemble customs unions, except that participant countries reserve the right to set their own tariffs on imports from the rest of the world, and "domestic content" or rules of origin regulations are required to limit the scope of the trading arrangement to goods produced primarily within the countries of the region.[13]

Note that analysis of customs unions or free trade agreements is distinct from the usual theoretical debates over the benefits of pursuing "free trade". Since such agreements do not include all countries, only a portion of total world trade is liberalized, and numerous trade and nontrade-related distortions remain after the formation of a customs union or free trade area. As a result, the relevant theory is concerned with the task of comparing different "second-best" situations, with the standard outcome that the greater realism permitted by departing from the unrealistic "first-best" case comes at the expense of the generality of the conclusions that can be drawn from theory alone. It is thus impossible to specify

[13] Robson (1987) identifies the two basic features that distinguish a free trade area from a customs union are that "the member countries retain the power to fix their own separate tariff rates on imports from the rest of the world; the area is equipped with rules of origin, designed to confine intra-area free trade to products originating in, or mainly produced in, the area." See Hazlewood (1987) and Gunter (1989) for recent surveys of theoretical work in this area.

general conditions under which the formation of a customs union or free trade area always results in an increase (or, indeed, a decrease) in welfare. The outcome is instead dependent on the relative strength of the "trade creation" and "trade diversion" effects; which effect dominates is an empirical question. In general, a free trade area increases welfare if its trade creation effects are relatively larger than its trade diversion effects; conversely, it lowers welfare if it diverts trade in net terms.[14]

Trade *creation* consists of the induced shift in demand away from domestically-produced, higher-cost products toward lower-cost products produced by FTA members. This shift results in production and consumption effects. The production effect is the savings generated by moving resources out of high-cost sectors (relative to other member countries). The consumption effect is a gain in consumers' surplus from the substitution of lower-cost foreign goods for higher-cost domestic goods.

Trade *diversion* consists of an induced shift in trade away from imports from non-FTA countries to potentially higher-cost imports from a FTA member (depending on the structure of protection of FTA members against excluded countries). With similar external tariff structures for FTA members, removing tariffs among members may only divert trade from non-members to members, with no change or even a decrease in welfare. The shift in trade structure has two potential effects. First, the cost of imported goods may increase (or at least not decrease), as they are now imported from a higher-cost FTA member. Second, consumers' surplus may decrease as a result of the substitution of higher-cost FTA-member goods for lower-cost foreign goods.

[14] Our definitions here follow Robson (1987). We describe the effects with reference to free trade areas, since these are the focus of our analysis in this paper; the case of customs unions is analogous. Our characterization of the welfare impact of is admittedly simplistic. Analysis of the sources of welfare gains and loses from customs unions or FTAs has generated an extensive literature; see Gunter (1989) for a recent survey.

Dynamic Effects of Free Trade Areas

Besides the static effects of trade creation and trade diversion, the creation of customs unions or FTAs could give rise to dynamic effects such as economies of scale, external economies, technical change, and increased investment. Dynamic effects include any effect that might increase the growth rate of economies participating in a customs union or FTA. The existing literature identifies numerous dynamic effects which affect different factor inputs, although there is relatively little consensus on the theoretical validity or empirical importance of these different linkages.[15]

Creation of a customs union or FTA leads to a larger internal market, permitting a greater degree of specialization, and leading ultimately to a reduction in costs. This cost reduction can result from fuller utilization of plant capacity, learning by doing, development of a pool of skilled labor and management, and so forth. Other dynamic effects include external economies, technical change, and change in investment. Of these effects, externalities in the form of technology spillovers are particularly important. According to Gunter and Meldrum (1993), technology spillovers take place when advancements in knowledge made by one economic unit are adopted by other economic units. The creation of customs unions increases the prevalence of technology spillover as trade barriers are reduced. Spillovers can also occur as union members adopt uniform standards which bring together experts from member countries. Spillovers could decrease the cost of innovations; increase an industry's competitiveness; and increase both the technology gap and the difference in average costs between members and non-members of the customs unions.

Related dynamic effects involve the possibility of increased technology transfer to developing countries as an externality associated with export-led growth. For instance, de Melo and Robinson (1992) suggest that these externality effects are an important factor behind the superior performance of countries

[15] Dynamic effects are summarized by Gunter and Meldrum (1993) with information from Baldwin (1989), El-Agraa (1989), and Gunter (1989).

pursuing export-led industrialization strategies relative to those committed to import substitution. They use a CGE model to examine the impact of externalities that arise not only from exporting but also from importing capital equipment which embodies developed-country technology.

Existing Empirical Analysis of Asian Integration

As noted in the above, the literature applying multi-country CGE models to evaluation of the impacts of economic integration is growing rapidly. The earlier models were used to analyze alternative tariff-cutting proposals in multilateral trade negotiations under the GATT (including the recently completed Uruguay Round) and other international trade policy issues such as North-South trade. More recent studies have concentrated on European Community market integration initiatives and the likely effects of the North American Free Trade Agreement (NAFTA) on current or future participants.[16]

The extensive CGE modeling efforts on Europe and North America economic integration reflect the demand for quantitative assessments of regional initiatives from policymakers in those regions, and these models have played an important role in the public debate over these efforts. The growing interest in economic cooperation in the Pacific Rim, along with East Asia's emergence as the principle engine of world economic growth, has led as well to increased demand for research similar to that conducted on Europe and North America. Until recently, however, contemporary analytic efforts on Asia remain rather limited relative to those on Europe or North America.

For example, Harrison and Kimbell (1986) developed a 12-region, 20-sector model to investigate the impact of trade liberalization and economic interdependence among Pacific Rim countries, although they did not explicitly include Hong Kong, Taiwan, and China in their study. Martin, Petri, and Yanagishima (1994) built a 19-region, 7-sector model to estimate the impact of concerted trade

[16] Early surveys of such models can be found in Shoven and Whalley (1984) and Fretz, Srinivasan, and Whalley (1986), while a more contemporary survey is available in Brown (1992).

liberalization among East Asia countries. While that model has broad regional coverage, it does not model the production structure explicitly: There are no primary factors or inter-industry linkages, so that the structural effects of trade policy change are not easily analyzed. Wang (1994) developed a seven-region, six-sector model for world production and trade to estimate the impact of economic integration among East Asia Chinese economies, but did not address policy issues related to APEC or ASEAN.

Contemporary efforts to build multi-regional CGE models for the Asia-Pacific region are underway by participants in the Purdue Global Trade Analysis Project (GTAP).[17] Among recent GTAP applications, Young and Chyc (1994) conduct experiments on a 10-region, 3-sector version of the basic GTAP model and compare three scenarios for APEC regional trade liberalization. They found that a trade reform package that extends MFN status to the rest of the world, but does not require reciprocity, is not desirable for the APEC member countries, and suggest instead that APEC members would be better off to withhold tariff reduction with the rest of the world until reciprocity can be agreed to. This policy suggestion is somewhat at odds with that of Martin, Petri, and Yanagishima (1994), who argue the case for a MFN-based liberalization in East Asia *without* requiring reciprocity from non-Asian regions.

The APEC CGE Model

The model developed in this paper consists of a multi-regional CGE framework containing a ten-sector, six-region, general equilibrium model, where the regional CGE models are inter-connected through trade flows.[18] For the purpose of describing the model, it is useful to distinguish between the individual "country" models and the multi-region model system as whole, which determines how the

[17] The primary reference to these efforts is Hertel (1995). The GTAP project is the source of much of the data used in our APEC model as well.

[18] The model also permits regional interactions through endogenous migration of capital and labor, but for all experiments presented in this paper, this feature is not used. See Hinojosa-Ojeda, Lewis, and Robinson (1994) for analysis of a Greater North America Free Trade Area (GNAFTA) using a similar model with labor migration permitted.

individual country models interact. When the model is actually used, the *within* country and *between* country relationships are solved for simultaneously.

The APEC CGE model includes several features that are not ordinarily incorporated into other multi-country CGE trade models. First, when modeling import demands, the Almost Ideal Demand System (AIDS) specification is adopted. This specification allows import expenditure elasticities to be different from one and also allows cross-country substitution elasticities to vary for different pairs of countries. Second, to capture the potential dynamic effects of trade liberalization, the APEC model can include equations for generating positive externalities through both export expansion and the importation of new capital goods. These new features will be described below.

The model data base consists of social accounting matrices (SAMs) for each country, including data on their trade flows.[19] The development of a consistent multi-country data base is itself a major task; for our model, we relied primarily on the GTAP database [Hertel (1995)], supplemented by some additional data on factor endowments, particularly labor and non-tariff barriers in Japan. The SAM starts from multisectoral input-output data, which are expanded to provide information on the circular flow of income from producers to factors to "institutions," which include households, enterprises, government, a capital account, and trade accounts for each partner country, and for the rest of the world. These institutions represent the economic actors whose behavior and interactions are described in the CGE models. The parameter estimates for the sectoral production functions, consumer expenditure functions, import aggregation functions, and export transformation functions were drawn from a variety of econometric and informal sources. The various parameters used in the model represent point estimates for the base year (1992) and the model was benchmarked so that its base equilibrium solution exactly replicates the base data.

[19] Social Accounting Matrices are described in Pyatt and Round (1985).

Each sub-regional or "country" CGE model follows closely what has become a standard theoretical specification for trade-focused CGE models.[20] In addition to ten sectors for each country model, the model has four factors of production (two labor types, land, and capital). For each sector, the model specifies output-supply and input-demand equations. Output is produced according to a CES production function of the primary factors, with intermediate inputs demanded in fixed proportions. Producers are assumed to maximize profits, implying that each factor is demanded so that marginal product equals marginal cost. However, factors need not receive a uniform wage or "rental" (in the case of capital) across sectors; it is possible to impose sectoral "factor market distortions" that fix the ratio of the sectoral return to a factor relative to the economywide average return for that factor.

In common with other CGE models, the model only determines relative prices and the absolute price level must be set exogenously. In our model, the aggregate consumer price index in each sub-region is set exogenously, defining the *numeraire*. The advantage of this choice is that solution wages and incomes are in real terms. The solution exchange rates in the sub-regions are also in real terms, and can be seen as equilibrium price-level-deflated (PLD) exchange rates, using the country consumer price indices as deflators.[21] World prices are converted into domestic currency using the exchange rate, including any tax or tariff components. Cross-trade price consistency is imposed, so that the world price of country A's exports to country B are the same as the world price of country B's imports from country A. Composite demand is for a CES aggregation of sectoral imports and domestic goods supplied to the domestic market. Sectoral output is a CET (constant elasticity of transformation) aggregation of total supply to all export markets and supply to the domestic market.

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[20] Robinson (1989) surveys CGE models applied to developing countries. Shoven and Whalley (1984) survey models of developed countries. The theoretical properties of this family of trade-focused CGE models are discussed in Devarajan, Lewis, and Robinson (1990). A full presentation of the APEC CGE model appears in the appendix of this paper.

[21] De Melo and Robinson (1989) and Devarajan, Lewis, and Robinson (1991) discuss the role of the real exchange rate in this class of model.

Each "country" model traces the circular flow of income from producers, through factor payments, to households, government, and investors, and finally back to demand for goods in product markets. The country models incorporate tariff and non-tariff revenues, which flow to the government. Each economy is also modelled as having a number of domestic market distortions. There are sectorally differentiated indirect, consumption, and export taxes, as well as household and corporate income taxes. The single aggregate household in each economy has a Cobb-Douglas expenditure function, consistent with optimization of a Cobb-Douglas utility function. Real investment and government consumption are fixed as a share of GDP in the model simulations.

One implication of including these varied existing distortions, which capture in a stylized way institutional constraints characteristic of the economies, is that policy choices must be made in a second-best environment. In our simulations involving the establishment of FTAs, we are not considering scenarios which remove all existing distortions. Existing taxes and factor-market distortions are assumed to remain in place, along with existing import barriers against the rest of the world. In this second-best environment, economic theory gives little guidance as to the welfare implications of forming a FTA.

Sectoral export-supply and import-demand functions are specified for each country. In common with other CGE models (both single and multi-country), the APEC CGE model specifies that goods produced in different countries are imperfect substitutes. At the sectoral level, in each country, demanders differentiate goods by country of origin and exporters differentiate goods by destination market. Exports are supplied according to a CET function between domestic sales and total exports, and allocation between export and domestic markets occurs in order to maximize revenue from total sales. The rest of the world is modeled as a large supplier of imports to and demander of exports from the six model regions as a group. Each regional economy faces downward-sloping demand curves for sectoral exports. Production activities in the rest of the world are not explicitly modeled; instead, this region is assumed to have flat export-supply curves and downward-sloping aggregate import-demand curves.

We have built the model to allow for the incorporation of three different kinds of trade-productivity links. The first relates sectoral productivity to sectoral imports of intermediate and capital goods—the extent of productivity increase depends on the share of intermediates in production. Second is an externality associated with sectoral export performance—higher export growth translates into increased domestic productivity. Finally, there is an externality associated with aggregate exports—increased exports make physical capital more productive, an effect which is "embodied" in the capital stock input to the production process.[22]

The externalities associated with imported intermediate input use (ρ^m) and sectoral export performance (ρ^e) affect productivity by entering into sectoral production functions [equation (1)], while the externality associated with aggregate exports (ρ^k) is directly "embodied" as an increase in the initial capital stock ($FS_{k,0}$) [equation (2)] and therefore enters the production function indirectly as an increase in the capital input. $F_{i,f}$ are the sectoral factor inputs into the production process (including capital); X_i is sectoral output, and FS_k is the economywide aggregate capital stock (so $FS_k = \Sigma_i F_{i,k}$).

(1) Production function:
$$X_i = \rho_i^m \cdot \rho_i^e \cdot \left[\sum_f \alpha^{i,f} F_{i,f}^{-\gamma^{i,f}} \right]^{\frac{-1}{\gamma^{i,f}}}$$

(2) Aggregate capital stock:
$$FS_{k,t} = FS_{k,0} \cdot \rho^k$$

The three externality relationships are shown in equations (3)-(5). *MTOT* and *ETOT* in equations (3) and (5) correspond to aggregate imports and exports for each region, E_i is sectoral exports, and n_i is the share of intermediate inputs in production. The subscripts *0* and *t* refer to the base period and experiment, respectively:

(3) Intermediate inputs:
$$\rho_i^m = \left(\frac{MTOT_t}{MTOT_0}\right)^{\eta_m} \cdot n_i + (1 - n_i)$$

[22] The various export and import externality features can be turned on or off as desired in carrying out model simulations.

(4) Sectoral exports: $$\rho_i^e = \left(\frac{E_{i,t}}{E_{i,0}}\right)^{\eta_e}$$

(5) Aggregate exports: $$\rho^k = \left(\frac{ETOT_t}{ETOT_0}\right)^{\eta_k}$$

Each of the three effects operates through simple elasticity equation: for example, an export-productivity elasticity (η^e) of 0.25 for industrial sector exports from developing regions means that a 10 percent rise in real exports would result in a 2.5 percent increase in total factor productivity in that sector. In general, the elasticities used for the industrialized regions (US, EU, Japan) are less than half the values used for the developing regions.

While there is fairly widespread agreement that these feedbacks exist, there is less consensus on the channels through which they operate, and how large they are. For our purpose, we are more interested in showing how such linkages might affect analysis of the FTA; thus, we have included three different linkages that operate through different channels. With little empirical estimation to draw on, the choice of externality parameters to use in the model is based largely on guesswork. We have chosen fairly modest parameters, to avoid overstating the case; for example, our sectoral export-productivity linkage effects for the developing Asian regions are given an elasticity parameter around one-half that used by de Melo and Robinson (1992) in their analysis of the Korean growth performance.

For many single-country and multi-country models, a lack of detailed econometric work forced modelers to use simple functional forms, with few parameters, for the import-aggregation and export-transformation functions. The common practice is to use a constant elasticity of substitution (CES) function for the import aggregation equation, which is a very restrictive functional form and has led to empirical problems.[23] As a result of these limitations, modelers have begun to explore other

[23] Armington (1969) used the specification in deriving import-demand functions, and the import aggregation functions are sometimes called Armington functions. Devarajan, Lewis, and Robinson (1990) discuss in detail the properties of single-country models which incorporate imperfect substitution. Brown (1987) analyzes the implications of using CES import aggregation functions in multi-country trade models. Others have criticized the use of the CES function on econometric grounds. See, for example, Alston *et al.* (1989).

formulations, while maintaining the fundamental assumption of product differentiation. In this model, we have used a flexible specification of the demand system called the almost ideal demand system (or AIDS).[24] The AIDS specification allows non-unitary income elasticities of demand for imports and also pairwise substitution elasticities that vary across countries. The specification generates more realistic trade-volume and terms-of-trade effects when analyzing the impact of expanded North American regional trade under an FTA. The inclusion of income effects, however, is really only a first step. It is important to explore other modeling approaches which permit the analysis of market penetration in environments of product differentiation and imperfect competition.[25]

The APEC CGE model, like other multi-country CGE models, has a medium to long-run focus. We assume, for example, that factor markets clear. While sectoral employment changes, aggregate employment is assumed to remain unchanged. We report the results of comparative static experiments in which we "shock" the model by changing some exogenous variables and then compute the changed equilibrium solution. We do not explicitly consider how long it might take the economy to reach the new equilibrium. The model's time horizon has to be viewed as "long enough" for full adjustment to occur, given the shock. While useful to understand the pushes and pulls the economies will face under the creation of an FTA, this approach has obvious shortcomings. In particular, it does not consider the costs of adjustment, such as transitional unemployment, that might occur while moving to the final equilibrium.

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[24] Hanson, Robinson, and Tokarick (1990) use the AIDS function in their 30-sector single-country CGE model of the U.S. They estimate the sectoral import demand functions using time-series data and find that sectoral expenditure elasticities of import demand are generally much greater than one in the U.S., results consistent with estimates from macroeconometric models.

[25] There is active theoretical work on this approach that should lead to empirically implementable formulations. See Helpman and Krugman (1985) and Venables and Smith (1986). Devarajan and Rodrik (1989) discuss the potential importance of incorporating such factors into CGE models of developing countries. Harris (1984) and Cox and Harris (1985) incorporate imperfect competition into a CGE model of Canada. De Melo and Tarr (1992) have built a CGE model of the U.S. which incorporates imperfect competition to analyze the impact of trade policy with respect to steel, automobiles, and textiles.

4. Towards Asian Free Trade: APEC Model Results

Design of Alternative Scenarios

The scenarios begin with consideration of the impact of an Asian Free Trade Area, then consider the implications of different regions not participating in (or being excluded from) the FTA: first China, then ASEAN4, and finally the US. We conclude by comparing the gains from the Asian FTA with more comprehensive trade liberalization encompassing areas outside of Asia. We also contrast the static gains from free trade arrangements with the more substantial improvements that might occur as a result of dynamic linkages between trade expansion and productivity. We specifically model three externality channels which have been identified empirically as important in export-led development, including the effects on aggregate and sectoral productivity of increased exports and the productivity-enhancing importation of new technologies via imports of capital and intermediate goods.

For each alternative scenario, the model generates results concerning the impact on real GDP, output, trade, value added, the real wages paid to each labor category, as well as the rental rate of capital and land. Trade diversion and trade creation impacts are evaluated through data on total, intra-regional, and extra-regional trade. However, our scenarios should be interpreted as controlled experiments rather than as forecasts of performance that might occur with each option. The actual growth pattern will be the result of many more factors than just trade policy, especially macro-economic and incomes policies. Both the comparative static and dynamic-externality experiments are meant to describe the impact of different patterns of trade liberalization in the medium to long run. Use of the term "dynamics" here does not imply the actual path of the transition, but rather the net cumulative effect over time of positive productivity externalities that could potentially result from regional integration.

The Impact of an Asian Free Trade Area

In this section, we consider the impact of creating an Asian Free Trade Area encompassing all the APEC regions in our model: US, Japan, Asian NIEs, China, and ASEAN4. We simulate this possibility by elimination of all tariff and non-tariff barriers to imports *among* the participants, leaving intact each region's tariffs with non-member regions (in our model, EU and the rest of the world). In Experiment 1A, tariffs are eliminated under the assumption that there are no externalities or dynamic productivity linkages, while in Experiment 1B, the tariff removal is combined with the three different productivity linkages described in the previous section.

Experiment 1A: Static Gains. Table 8 presents the impact on macro and aggregate trade variables for Experiment 1A, in which tariffs among all five APEC economies are removed entirely. It is clear from the macro results that the impact of an Asian FTA is quite varied across the member economies. Growth in total exports ranges from 3-4 percent in the US and China, to around 5-6 percent in the Asian NIEs, ASEAN4, and Japan. Export/output shares rise by more than a percentage point in ASEAN4 and the Asian NIES. Real GDP growth, which measures the increased domestic production (at base-period prices), ranges from near zero for the US and China, to an increase of 0.6 percent for ASEAN4, 0.9 percent for Japan, and 2.6 percent for the Asian NIEs. Real absorption growth, defined as the change in government and private consumption and investment (at base-period prices), follows a similar pattern.

The second section of the table summarizes the impact of the FTA on aggregate exports. The first column shows *trade expansion,* defined as the total increase in exports for each region; the second column shows *trade creation*, defined as the increment in exports to countries *inside* the FTA, and the third column shows *trade diversion,* or the change in trade to countries *outside* the FTA. The last three columns show the same three measures, expressed as percentage growth from the base data. The FTA easily satisfies the requirement that trade expansion exceeds trade diversion -- new trade within the region

Table 8: Asian Free Trade Area: Macro and Trade Performance (Experiment 1A: No Productivity Linkages)

	Percentage change from base				
	Real GDP	Real Absorption	Real exchange rate	Terms of trade	Export/ output share
United States	0.03	0.04	2.29	0.03	0.18
Japan	0.88	0.74	7.29	-1.33	0.47
China	0.07	0.13	2.55	0.07	0.54
ASEAN 4	0.56	0.36	3.09	-0.40	1.36
Asian NIEs	2.61	2.44	8.51	-0.33	1.01
European Union	0.0	0.05	0.0	0.41	-0.0

	Billion US$			Percentage change from base:		
	Trade expansion	Trade creation	Trade diversion	Trade expansion	Trade creation	Trade diversion
United States	15.22	32.22	-17.00	2.64	19.70	-4.12
Japan	26.31	30.27	-3.96	6.46	13.09	-2.25
China	5.38	13.03	-7.65	3.79	16.97	-11.77
ASEAN 4	8.41	5.89	2.52	6.12	6.35	5.65
Asian NIEs	14.73	14.00	0.73	5.76	8.98	0.73
Total, FTA members	70.04	95.41	-25.37			
European Union	-0.18	-9.20	9.02	-0.02	-4.32	1.74

Notes: *Real GDP* (C+I+G+E-M) provides a production-based measure of economic activity.
Real Absorption (C+I+G) provides a welfare measure based on economywide real final demand by households, government, and investment. Changes in this measure equal the *equivalent variation* for the economy, with changes in government consumption and investment valued according to private consumer's preferences.
Export/output share indicates the change in the aggregate export/output ratio for the economy.
Trade expansion is the increase in total exports for each region.
Trade creation is the increase in exports to *members of the FTA*; the trade creation figure for the European Union indicates the change in EU exports to FTA members.
Trade diversion is the increase in exports to *non-FTA members*, comprised of EU and rest of world.

is nearly four times larger than the decline of trade with regions outside the FTA, with the net expansion on the order of $70 billion. While this criteria is also satisfied for each member of the FTA, the balance between trade creation and diversion varies significantly across regions: for the US, trade diverted represents around one half of trade created, while in Japan, the proportion is only around ten percent. For both ASEAN4 and the Asian NIEs, there is no diversion: exports to non-FTA members actually rise.

In general terms, these results are consistent with findings from other modelling efforts of the impact of free trade. Despite the small individual declines in absorption or consumption, the aggregate changes in these magnitudes are positive: For APEC as whole, GDP rises by $52 billion and absorption by $45 billion. The larger consumption (welfare) gains accrue to those regions that had the highest initial average levels of tariff protection: Japan, ASEAN4, and Asian NIEs. But in order to understand fully the factors shaping these aggregate outcomes, it is necessary to look at the impact on sectoral structure.

Table 9: Asian Free Trade Area: Change in Bilateral Trade Balances (Exp. 1A)
(Change from Base: Billion US$)

Change in trade balance from:	United States	Japan	China	ASEAN4	Asian NIEs	EU
With region:						
United States	-	-0.88	1.07	-1.19	-5.72	-3.62
Japan	0.88	-	2.80	-1.24	2.96	-2.76
China	-1.07	-2.80	-	-0.42	-1.97	-0.61
ASEAN 4	1.19	1.24	0.42	-	1.72	-1.22
Asian NIEs	5.72	-2.96	1.97	-1.72	-	-0.85
European Union	3.62	2.76	0.61	1.22	0.85	-
Rest of World	-10.35	2.64	-6.88	3.35	2.17	9.06
Sum	0.0	0.0	0.0	0.0	0.0	0.0

Note: Trade balance defined as exports minus imports.

Underlying the expansion in aggregate trade are significant shifts in bilateral trade flows. Table 9 shows the *change* in the bilateral trade balances for each region in the model. The columns refer to the exporting region, the rows to the importing region; a positive number implies an *increase* in the bilateral trade balance for the exporter compared to the base. Thus, the value of $0.88 billion in the upper left corner implies that the bilateral trade balance from the US to Japan rose by that amount, compared to the base; in other words, US export growth to Japan exceeded import growth from Japan.[26] The biggest shift in these flows occurs in the US-Asian NIEs relationship, where elimination of trade barriers among the APEC members results in a $5.7 billion *fall* in the initial $11 billion trade deficit

[26] Because we assume that the *aggregate* trade balance for each region remains unchanged, each column sums to zero.

between the US and Asian NIEs. It is notable that there is virtually no change in the US-Japan bilateral balance from establishing an APEC FTA. For the developing country members of APEC, the patterns differ markedly. ASEAN4 witnesses declining net trade with all other Asian regions and the US, and instead expands its trade by penetrating export markets in the EU and rest of the world; China experiences expansion in net trade with all regions *except* the rest of the world. The EU experiences worsening trade balances with all Asian markets, making up the losses through increased exports to the rest of the world. Some regions expand their net trade with the rest of the world (Japan, ASEAN4, and Asian NIEs), while others (US and China) increase net trade within APEC and suffer declining balances with the rest of the world.

Table 10 decomposes the aggregate trade performance by portraying changes in export flows for each region by sector and destination. Looking first at the Japan-US flows, the greatest expansion in exports from the US to Japan is in grains (around $10.5 billion), driven by the elimination of the 470 percent tariff and NTB protection that had existed in Japan; other contributions to growth occur in intermediate and capital goods sectors, where sizeable NTBs are eliminated as well. Japanese export expansion to the US, on the other hand, is concentrated almost exclusively in the machinery and equipment category ($19 billion), with an smaller increment of $2 billion in intermediate products. Again, US tariffs against Japanese products in these two sectors are the highest, although at 22-24 percent the distortions are much smaller than those eliminated in Japan. US export expansion to other Asian regions is varied: while substantial export growth to the Asian NIEs occurs in agricultural products, growth to ASEAN4 and China is relatively modest and concentrated in intermediates and capital equipment as well. Japanese exports to other Asian regions are concentrated in the intermediates and capital goods sectors.

For China and ASEAN4, the results suggest that there are important complementarities in their export opportunities within the context of greater Asian free trade. While textiles and apparel account

Table 10: Change in Sectoral Exports by Destination (Exp. 1A)
(Change from Base: Billion US$)

	USA	Japan	China	ASEAN4	Asian NIES	EU	Rest of world	Total
United States								
Grains	-	10.54	-0.01	0.02	2.14	0.0	-12.30	0.40
Other Agriculture	-	2.26	0.16	0.42	3.48	0.0	-5.91	0.43
Forestry & Fishery	-	-0.16	0.03	0.09	0.04	0.0	0.17	0.17
Energy & Minerals	-	-0.05	-0.0	0.02	0.02	0.0	0.28	0.27
Food Processing	-	1.50	0.09	0.17	0.25	0.0	-1.45	0.56
Textile & Apparel	-	0.32	0.10	0.09	0.17	-0.01	0.33	1.00
Wood & Paper	-	-0.10	-0.0	0.06	0.10	0.0	0.53	0.59
Basic Intermediates	-	3.56	0.32	0.34	0.65	0.02	-3.07	1.83
Machinery & Equipment	-	4.73	0.21	0.68	1.08	-0.01	0.31	7.00
Services	-	-0.99	-0.0	-0.0	-0.10	-0.04	4.11	2.97
Total	-	22.43	0.89	1.88	8.01	-0.0	-18.00	15.20
Japan								
Grains	0.0	-	0.0	0.0	0.0	0.0	0.0	0.0
Other Agriculture	0.0	-	0.0	0.01	0.17	0.0	-0.09	0.10
Forestry & Fishery	-0.0	-	0.0	0.08	0.0	0.0	0.02	0.12
Energy & Minerals	-0.0	-	0.0	0.0	0.0	0.0	0.03	0.05
Food Processing	0.02	-	0.02	0.02	0.04	0.0	0.25	0.35
Textile & Apparel	0.27	-	0.81	0.36	0.40	-0.06	0.67	2.45
Wood & Paper	0.03	-	0.05	0.08	0.04	0.0	0.04	0.23
Basic Intermediates	1.90	-	0.69	0.95	1.27	0.03	-3.87	0.97
Machinery & Equipment	18.67	-	1.08	2.54	1.05	0.15	-5.18	18.30
Services	-0.16	-	-0.04	-0.0	-0.10	-0.02	4.07	3.75
Total	20.68	-	2.63	4.05	2.88	0.10	-4.00	26.35
China								
Grains	0.0	2.22	-	0.02	3.32	0.0	-5.53	0.03
Other Agriculture	0.03	0.78	-	0.18	0.71	0.0	-1.62	0.08
Forestry & Fishery	-0.0	-0.04	-	0.0	0.0	0.0	0.05	0.02
Energy & Minerals	0.0	-0.09	-	0.06	0.03	-0.0	0.01	0.01
Food Processing	0.02	0.17	-	0.11	0.05	0.0	-0.31	0.03
Textile & Apparel	1.71	1.49	-	0.35	0.26	-0.06	0.20	3.94
Wood & Paper	0.0	-0.01	-	0.02	0.01	0.0	0.02	0.04
Basic Intermediates	0.27	0.79	-	0.24	0.17	0.0	-1.37	0.10
Machinery & Equipment	-0.03	0.24	-	0.10	0.04	-0.02	0.63	0.96
Services	-0.04	-0.11	-	-0.0	-0.03	-0.0	0.33	0.15
Total	1.90	5.47	-	1.06	4.62	-0.08	-7.81	5.16
ASEAN 4								
Grains	0.0	0.05	-0.0	-	-0.03	0.0	-0.0	0.0
Other Agriculture	0.07	1.09	0.03	-	1.45	0.0	-2.56	0.08
Forestry & Fishery	-0.01	-0.15	0.05	-	0.0	-0.0	0.0	-0.11
Energy & Minerals	-0.02	-0.24	0.02	-	0.11	-0.0	-0.46	-0.59
Food Processing	0.12	0.26	0.18	-	-0.04	0.0	-0.45	0.07
Textile & Apparel	0.56	0.31	0.03	-	0.14	-0.04	3.29	4.28
Wood & Paper	0.05	0.12	0.22	-	0.15	0.0	-0.41	0.13
Basic Intermediates	0.04	1.23	0.08	-	0.19	-0.0	-1.62	-0.08
Machinery & Equipment	-0.09	0.38	0.07	-	-0.23	-0.05	4.47	4.55
Services	-0.03	-0.24	-0.01	-	-0.02	0.0	0.35	0.05
Total	0.64	2.77	0.65	-	1.71	-0.09	2.62	8.30
Asian NIEs								
Grains	0.0	0.0	0.0	0.0	-	0.0	0.02	0.02
Other Agriculture	0.0	0.55	0.01	0.03	-	0.02	0.19	0.80
Forestry & Fishery	-0.0	-0.03	0.0	0.24	-	0.0	0.22	0.43
Energy & Minerals	-0.0	-0.0	0.0	0.01	-	-0.0	-0.03	-0.01
Food Processing	0.03	1.05	0.06	0.07	-	0.0	1.11	2.32
Textile & Apparel	1.05	1.10	1.47	1.32	-	-0.06	3.30	8.19
Wood & Paper	0.04	0.0	0.09	0.10	-	0.0	-0.21	0.02
Basic Intermediates	0.20	2.70	0.61	0.84	-	0.0	-4.15	0.19
Machinery & Equipment	0.89	0.82	0.36	0.85	-	-0.05	0.63	3.50
Services	-0.09	-0.36	-0.02	-0.0	-	0.01	-0.27	-0.74
Total	2.12	5.91	2.59	3.46	-	-0.07	0.89	14.90
European Union								
Grains	-0.0	-0.01	-0.0	-0.0	-0.04	-	0.07	0.01
Other Agriculture	-0.02	-0.07	-0.0	-0.0	-0.05	-	0.17	0.03
Forestry & Fishery	-0.0	-0.03	-0.0	-0.0	-0.0	-	0.04	0.0
Energy & Minerals	-0.07	-0.03	-0.0	-0.0	-0.0	-	0.10	-0.01
Food Processing	-0.14	-0.34	-0.04	-0.03	-0.15	-	0.67	-0.03
Textile & Apparel	-0.15	-0.19	-0.03	-0.0	0.09	-	0.24	-0.05
Wood & Paper	-0.07	-0.04	-0.02	-0.01	-0.0	-	0.12	-0.03
Basic Intermediates	-0.56	-0.52	-0.13	-0.13	-0.06	-	1.21	-0.20
Machinery & Equipment	-2.40	-0.89	-0.42	-1.10	-0.67	-	5.63	0.14
Services	-0.22	-0.53	-0.02	-0.0	-0.04	-	0.77	-0.04
Total	-3.62	-2.71	-0.68	-1.30	-1.02	-	9.12	-0.21

for most of the export increase for these two regions to the US, growth in exports destined for Japan occurs in the grains and textile sectors for China, and in the other agriculture and basic intermediate sectors for ASEAN4. China exports more grains to the Asian NIEs, while ASEAN4 increases it other agricultural exports to this group.

Table 11 illustrates the extent of structural change occurring in the FTA economies by reporting the percentage changes in output, export, and import quantities, as well as the reallocation of labor and capital as a result of the tariff reductions.[27] The changes in output as a result of an Asian FTA reveal the extent to which existing patterns of import protection determine economic structure. Output of grains falls by one-fifth in Japan and one-sixth in the Asian NIEs and imports rise sharply as the substantial agricultural protection in these economies is eliminated. The increased US grain exports to these markets occurs not as a result of increased output (which increases by only 1 percent), but rather through diversion of exports from other markets, particularly the rest of the world. In Japan, there is a massive movement of capital out of agriculture sectors, and agricultural labor from the grains sector.[28] In the developing regions of Asia, ASEAN4 output of machinery and equipment and textiles grows by 12 percent each, while resource-based sectoral outputs generally fall. China experiences much less structural transformation in terms of output structure, with a 4 percent shift into textiles the biggest change.

[27] Little structural change occurs in the EU because of its exclusion from the Asian FTA, so results for this region are not reported in the table. Because exports and imports are reported here in real terms, not dollar values, the figures differ from those reported in earlier tables. Aggregate capital and aggregate labor are fixed, so the sum of changes in factor use is zero; also, agricultural labor is employed only in the first three agricultural sectors, while non-agricultural labor works in the remaining sectors.

[28] At present, agricultural and non-agricultural labor are kept separate, which is responsible for some of the large re-allocations of capital and labor in Japan and the Asian NIEs. Alternative simulations not reported here allow rural-urban migration, thereby facilitating adjustment and reducing the extent of capital reallocation, although the pattern of results changes very little.

Table 11: Asian Free Trade Area: Structural Change (Exp. 1A: No Productivity Linkages)
(Percent Change from Base)

	Output	Exports	Imports	Labor	Capital
United States					
Grains	0.9	4.1	-2.5	0.4	1.8
Other Agriculture	0.3	3.8	-0.7	-0.3	1.1
Forestry & Fishery	1.2	3.9	-1.7	0.4	1.8
Energy & Minerals	0.7	3.5	-2.0	0.7	0.7
Food Processing	0.0	3.1	-1.1	0.0	-0.0
Textile & Apparel	1.0	4.8	5.0	1.0	0.9
Wood & Paper	0.3	3.3	-1.5	0.3	0.2
Basic Intermediates	0.1	3.1	1.5	0.1	0.0
Machinery & Equipment	-0.4	3.4	6.8	-0.4	-0.4
Services	-0.0	2.3	-1.4	-0.0	-0.0
Total	0.0	3.2	3.1		
Japan					
Grains	-19.8	67.2	299.6	-22.4	-37.5
Other Agriculture	1.1	34.1	48.4	8.0	-13.0
Forestry & Fishery	6.2	23.6	-5.1	17.0	-5.8
Energy & Minerals	1.7	7.1	-3.9	1.5	2.0
Food Processing	5.6	27.1	13.7	5.4	5.9
Textile & Apparel	2.7	11.4	14.3	2.6	3.0
Wood & Paper	0.4	8.1	-2.0	0.3	0.7
Basic Intermediates	-1.5	4.3	19.9	-1.7	-1.3
Machinery & Equipment	1.9	9.1	11.9	1.7	2.2
Services	-0.3	5.8	-3.6	-0.4	0.0
Total	0.3	8.3	8.7		
China					
Grains	-0.5	2.5	-2.8	-0.3	-2.6
Other Agriculture	-0.1	2.5	6.5	0.2	-2.2
Forestry & Fishery	-0.7	1.4	6.0	-0.2	-2.6
Energy & Minerals	-0.6	0.3	-0.6	-0.9	-0.4
Food Processing	-0.9	0.9	6.0	-1.3	-0.8
Textile & Apparel	4.0	8.1	13.0	3.7	4.2
Wood & Paper	-1.1	1.9	7.0	-1.4	-0.8
Basic Intermediates	-1.1	1.1	5.5	-1.4	-0.9
Machinery & Equipment	0.3	4.1	2.9	-0.0	0.5
Services	-0.2	0.8	-0.7	-0.5	0.0
Total	0.2	4.6	4.3		
ASEAN 4					
Grains	-1.9	0.8	0.8	-0.0	-4.3
Other Agriculture	-1.7	1.4	24.6	-0.0	-4.3
Forestry & Fishery	-3.4	-2.4	36.3	0.0	-4.3
Energy & Minerals	-3.5	-4.0	0.3	-4.5	-3.4
Food Processing	-1.4	0.9	9.1	-2.2	-1.1
Textile & Apparel	12.2	21.1	27.8	11.2	12.6
Wood & Paper	-0.1	1.7	8.7	-0.9	0.3
Basic Intermediates	-2.5	-1.0	8.1	-3.4	-2.3
Machinery & Equipment	11.6	17.7	5.9	10.7	12.0
Services	-0.2	0.3	-0.5	-1.0	0.2
Total	0.9	7.5	7.5		
Asian NIEs					
Grains	-17.9	81.9	221.2	-27.8	-44.4
Other Agriculture	2.8	42.2	92.8	9.9	-15.4
Forestry & Fishery	9.3	18.8	1.9	25.5	-3.4
Energy & Minerals	-1.8	-2.7	0.3	-2.1	-1.4
Food Processing	19.9	54.3	-0.1	19.6	20.4
Textile & Apparel	14.7	19.1	8.8	14.4	15.1
Wood & Paper	-0.3	0.4	5.1	-0.6	0.0
Basic Intermediates	-0.1	0.7	6.0	-0.5	0.1
Machinery & Equipment	1.4	4.2	2.4	1.2	1.8
Services	-1.4	-1.8	-0.9	-1.7	-1.1
Total	1.7	7.0	7.0		

Table 12: Asian Free Trade Area: Macro and Trade Performance (Experiment 1B: Trade-Productivity Dynamic Linkages)

	Percentage change from base				
	Real GDP	Real Absorption	Real exchange rate	Terms of trade	Export/ output share
United States	0.19	0.21	2.22	0.11	0.18
Japan	1.44	1.31	7.14	-1.37	0.47
China	2.16	2.04	2.17	-0.30	0.63
ASEAN 4	4.72	4.21	2.34	-1.13	1.62
Asian NIEs	3.21	3.05	8.45	-0.30	1.04
European Union	0.0	0.06	0.0	0.49	-0.0

	Billion US$			Percentage change from base		
	Trade expansion	Trade creation	Trade diversion	Trade expansion	Trade creation	Trade diversion
United States	16.18	34.76	-18.59	2.81	21.26	-4.50
Japan	28.66	33.37	-4.71	7.04	14.43	-2.68
China	8.94	13.76	-4.82	6.30	17.92	-7.41
ASEAN 4	15.24	6.48	8.76	11.09	6.99	19.63
Asian NIEs	16.42	16.70	-0.28	6.42	10.71	-0.28
Total, FTA members	85.43	105.07	-19.63			
European Union	-0.27	-7.38	7.12	-0.04	-3.47	1.37

Notes: ***Real GDP*** (C+I+G+E-M) provides a production-based measure of economic activity.
Real Absorption (C+I+G) provides a welfare measure based on economywide real final demand by households, government, and investment. Changes in this measure equal the *equivalent variation* for the economy, with changes in government consumption and investment valued according to private consumer's preferences.
Export/output share indicates the change in the aggregate export/output ratio for the economy.
Trade expansion is the increase in total exports for each region.
Trade creation is the increase in exports to *members of the FTA*; the trade creation figure for the European Union indicates the change in EU exports to FTA members.
Trade diversion is the increase in exports to *non-FTA members*, comprised of EU and rest of world.

Experiment 1B: Trade-Productivity Linkages. The results from Experiment 1A include no linkages or externalities from greater openness and trade expansion. While this clean comparative static experiment does allow calculation of the efficiency and welfare gains from introduction of the FTA, it also misses some possible important effects. In particular, empirical evidence suggests that there are

positive dynamic feedbacks between trade and productivity which, if captured correctly, would tend to increase the benefits accruing to FTA participants and change the pattern of trade and structural change.

Table 12 summarizes the macro and trade implications of an Asian FTA when these three productivity linkages are incorporated. Any ambiguity from the previous experiment over the attractiveness of the FTA to its members is eliminated in this scenario. GDP, absorption, and consumption rise for all participants; aggregate APEC GDP rises by $112 billion, and aggregate absorption rises by $103 billion. The biggest relative gainers are China and ASEAN4, where GDP and absorption growth increase by 2-4 percentage points compared to the previous experiment. Overall trade expansion rises, although the impact again varies by region: ASEAN4 and China benefit the most, with ASEAN4 export growth reaching 11 percent. Aggregate trade creation is more than five times greater than trade diversion. More than half of ASEAN4 export growth occurs through higher exports to EU and the rest of the world, with nearly all export expansion over Experiment 1A occurring to markets outside APEC.

Table 13: Asian Free Trade Area: Change in Bilateral Trade Balances (Exp. 1B)
(Change from Base: Billion US$)

Change in trade balance from:	USA	Japan	China	ASEAN4	Asian NIEs	EU
With region:						
United States	-	-1.39	0.59	-2.15	-6.06	-3.48
Japan	1.39	-	2.12	-2.71	2.84	-2.54
China	-0.59	-2.12	-	-0.59	-1.36	-0.09
ASEAN 4	2.15	2.71	0.59	-	3.13	-0.38
Asian NIEs	6.06	-2.84	1.36	-3.13	-	-0.67
European Union	3.48	2.54	0.09	0.38	0.67	-
Rest of World	-12.48	1.09	-4.75	8.20	0.79	7.15
Sum	0.0	0.0	0.0	0.0	0.0	0.0

Note: Trade balance defined as exports minus imports.

Table 13 shows the impact on bilateral trade balances. The US deficit with Japan is narrowed by $1.4 billion, but this effect is swamped by movements in the US balance with other bilateral partners,

again suggesting the futility of focusing on *bilateral* trade balances in a world driven by *multilateral* trading patterns. The shifting geographical focus of ASEAN4 trade is evident by the deteriorating trade balances with APEC regions, but improvements with EU and the rest of the world -- in some sense, ASEAN4 is filling markets in the rest of the world that have been abandoned by other FTA members.

Table 14 portrays changes in sectoral exports by destination for each economy in the region. $2.5 billion of the total $7 billion increase in ASEAN4 exports over Experiment 1A occurs in the capital goods sector, and $4 billion more in textiles growth. For China, the net export increment of $3.5 billion is concentrated in the textile sector ($2 billion), with expansion also occurring in intermediates and capital equipment. Relatively little change occurs in the pattern of export growth within APEC: the industrial economies of Japan and the US exhibit some additional penetration of ASEAN4 and China, but most of their export growth occurring to the rest of the world. Only for the Asian NIEs is the pattern different: most of the export growth in these economies occurs from broad-based export growth to ASEAN4 and China, with modest diversion of exports from the rest of the world to ASEAN4 and China.

The Costs of Exclusion from the Asian FTA

The scenarios reported in the previous section are based on the assumption that all of the members of APEC are willing and able to participate in a possible Asian FTA. However, despite the apparent agreement at the November 1994 APEC meetings in Bogor on the goal of free trade by 2020, this outcome is not the only one possible. Both international and domestic pressures could still yield outcomes in which one or more APEC member chose not to participate, or was excluded from such an arrangement. Chinese difficulties at entering GATT/WTO, reluctance by some APEC members to include the US, and misgivings by some ASEAN members over the goal of free trade could over time contribute to evolution of an FTA composed of only a subset of current APEC members.

Table 14: Change in Sectoral Exports by Destination (Exp. 1B)
(Change from Base: Billion US$)

	USA	Japan	China	ASEAN4	Asian NIES	EU	Rest of world	Total
United States								
Grains	-	10.70	0.0	0.03	2.19	0.0	-12.54	0.39
Other Agriculture	-	2.33	0.20	0.49	3.58	0.0	-6.18	0.42
Forestry & Fishery	-	-0.11	0.04	0.10	0.05	0.0	0.10	0.17
Energy & Minerals	-	-0.04	0.0	0.03	0.02	0.0	0.25	0.28
Food Processing	-	1.53	0.12	0.20	0.26	0.0	-1.52	0.60
Textile & Apparel	-	0.33	0.14	0.15	0.20	-0.02	0.33	1.13
Wood & Paper	-	-0.09	0.0	0.09	0.11	0.01	0.50	0.64
Basic Intermediates	-	3.63	0.40	0.48	0.72	0.03	-3.31	1.95
Machinery & Equipment	-	4.82	0.41	1.18	1.18	-0.01	0.09	7.67
Services	-	-0.81	0.09	0.06	-0.04	-0.03	3.68	2.94
Total	-	23.12	1.39	2.81	8.43	0.0	-19.60	16.16
Japan								
Grains	0.0	-	0.0	0.0	0.0	0.0	0.0	0.0
Other Agriculture	0.0	-	0.0	0.02	0.18	0.0	-0.11	0.09
Forestry & Fishery	-0.0	-	0.0	0.10	0.01	0.0	0.0	0.11
Energy & Minerals	0.0	-	0.0	0.01	0.0	0.0	0.02	0.05
Food Processing	0.02	-	0.03	0.03	0.04	0.0	0.25	0.37
Textile & Apparel	0.29	-	0.98	0.54	0.46	-0.06	0.52	2.71
Wood & Paper	0.03	-	0.06	0.10	0.04	0.0	0.01	0.25
Basic Intermediates	1.92	-	0.82	1.35	1.37	0.03	-4.39	1.09
Machinery & Equipment	18.79	-	1.53	3.55	1.19	0.16	-5.03	20.18
Services	-0.14	-	0.04	0.04	-0.04	-0.02	3.91	3.79
Total	20.86	-	3.49	5.74	3.25	0.11	-4.76	28.70
China								
Grains	0.0	2.25	-	0.03	3.38	0.0	-5.65	0.0
Other Agriculture	0.03	0.80	-	0.22	0.73	-0.0	-1.78	-0.0
Forestry & Fishery	-0.0	-0.03	-	0.0	0.01	0.0	0.03	0.0
Energy & Minerals	0.0	-0.07	-	0.09	0.03	0.0	0.04	0.10
Food Processing	0.02	0.17	-	0.13	0.05	0.0	-0.34	0.03
Textile & Apparel	1.72	1.53	-	0.44	0.28	-0.08	2.18	6.07
Wood & Paper	0.0	-0.0	-	0.02	0.01	0.0	0.06	0.10
Basic Intermediates	0.28	0.80	-	0.31	0.19	0.0	-1.26	0.33
Machinery & Equipment	-0.03	0.25	-	0.17	0.05	-0.03	1.40	1.80
Services	-0.03	-0.09	-	0.03	-0.01	-0.0	0.63	0.51
Total	1.93	5.62	-	1.44	4.74	-0.12	-4.95	8.66
ASEAN 4								
Grains	0.0	0.05	0.0	-	-0.03	0.0	-0.02	0.0
Other Agriculture	0.08	1.11	0.04	-	1.50	-0.0	-2.78	-0.05
Forestry & Fishery	-0.01	-0.11	0.06	-	0.01	-0.0	-0.06	-0.11
Energy & Minerals	-0.01	-0.18	0.04	-	0.13	-0.0	-0.72	-0.74
Food Processing	0.12	0.27	0.20	-	-0.03	0.0	-0.43	0.13
Textile & Apparel	0.54	0.31	0.05	-	0.19	-0.08	7.21	8.22
Wood & Paper	0.05	0.13	0.25	-	0.17	0.0	-0.39	0.22
Basic Intermediates	0.04	1.26	0.09	-	0.22	0.0	-1.53	0.08
Machinery & Equipment	-0.12	0.38	0.11	-	-0.23	-0.07	7.03	7.10
Services	-0.03	-0.20	0.02	-	-0.0	-0.0	0.61	0.39
Total	0.62	3.00	0.86	-	1.88	-0.15	9.01	15.22
Asian NIEs								
Grains	0.0	0.0	0.0	0.0	-	0.0	0.02	0.02
Other Agriculture	0.0	0.56	0.02	0.04	-	0.02	0.12	0.76
Forestry & Fishery	-0.0	-0.01	0.0	0.27	-	0.0	0.15	0.41
Energy & Minerals	-0.0	-0.0	0.01	0.02	-	-0.0	-0.05	-0.02
Food Processing	0.03	1.08	0.07	0.10	-	0.0	1.15	2.43
Textile & Apparel	1.06	1.13	1.71	1.69	-	-0.07	4.02	9.54
Wood & Paper	0.04	0.0	0.11	0.13	-	0.0	-0.27	0.01
Basic Intermediates	0.21	2.75	0.77	1.35	-	0.0	-4.83	0.24
Machinery & Equipment	0.94	0.85	0.61	1.41	-	-0.06	-0.04	3.71
Services	-0.08	-0.29	0.04	0.07	-	0.01	-0.46	-0.71
Total	2.20	6.17	3.35	5.06	-	-0.08	-0.09	16.62
European Union								
Grains	-0.0	-0.01	-0.0	0.0	-0.04	-	0.06	0.01
Other Agriculture	-0.01	-0.07	0.0	0.0	-0.04	-	0.15	0.03
Forestry & Fishery	-0.0	-0.03	0.0	0.0	-0.0	-	0.03	-0.0
Energy & Minerals	-0.06	-0.02	0.0	0.02	0.0	-	0.04	-0.02
Food Processing	-0.13	-0.33	-0.0	0.0	-0.14	-	0.56	-0.04
Textile & Apparel	-0.13	-0.17	0.03	0.04	0.12	-	0.09	-0.02
Wood & Paper	-0.07	-0.04	-0.0	0.0	-0.0	-	0.08	-0.03
Basic Intermediates	-0.53	-0.49	-0.05	0.05	-0.02	-	0.79	-0.24
Machinery & Equipment	-2.36	-0.86	-0.21	-0.68	-0.61	-	4.82	0.10
Services	-0.19	-0.43	0.03	0.04	-0.01	-	0.49	-0.07
Total	-3.47	-2.48	-0.19	-0.52	-0.85	-	7.22	-0.29

As these pressures will be played out primarily in the political arena, the model is of little use in predicting the outcome. But it is possible to use the model to consider the economic implications of excluding regions from the FTA. In this section, we consider the impact of three different configurations: an Asian FTA (1) without China; (2) without ASEAN4; and (3) without the US, relating the results to our earlier analysis of the full FTA, including trade-productivity linkages (Experiment 1B).

Table 15 indicates the macroeconomic implications of these alternative FTA membership possibilities. The first set of numbers repeat the findings for Experiment 1B, reported on earlier; the next three sets report results for separate simulations in which one region is excluded from the FTA. The results clearly demonstrate that there are gains from making the FTA as broad as possible. Omitting any one region makes that region significantly worse off, and lowers the gains from the FTA for *all* other members as well. As expected from the export results reported earlier, the Asian NIEs have the most to gain from broad membership in the FTA: exclusion of China reduces Asian NIE GDP and absorption gains by half, and exclusion of the US generates even larger declines. Aside from the Asian NIEs, exclusion of the US from the FTA has the greatest impact on Japan, reflecting the importance of its potential trade expansion to US markets: Japanese GDP growth drops from 1.4 to only 0.5 percent, and export growth falls from 7 to 3 percent. As further indication of their complementarity, ASEAN4 and China have relatively little impact on one another: ASEAN4 loses 0.5 percent when China is excluded, while China loses only around 0.2 percent when ASEAN4 is excluded.

Table 16 summarizes the impact of the alternative FTA options on trade performance. The broad results are consistent across experiments: regions excluded from the FTA witness a fall in exports relative to the base, and a loss of markets to the FTA. Excluding China reduces US export expansion by $1.5 billion, although this occurs as trade creation within the smaller FTA *rises* by $2 billion, which is more than offset by a fall in exports to the rest of the world; excluding ASEAN4 lowers US trade creation opportunities by $2 billion. Excluding either China or ASEAN4 lowers overall Japanese trade expansion

Table 15: Macro Performance for Alternative FTA Membership (Including Trade-Productivity Dynamic Linkages)

	Percentage change from base				
	Real GDP	Real Absorption	Real exchange rate	Terms of trade	Export/ output share
Full Asian FTA					
United States	0.19	0.21	2.22	0.11	0.18
Japan	1.44	1.31	7.14	-1.37	0.47
China	2.16	2.04	2.17	-0.30	0.63
ASEAN 4	4.72	4.21	2.34	-1.13	1.62
Asian NIEs	3.21	3.05	8.45	-0.30	1.04
European Union	0.0	0.06	0.0	0.49	-0.0
FTA Excluding China					
United States	0.17	0.18	2.00	0.02	0.17
Japan	1.20	1.07	6.25	-1.32	0.42
ASEAN 4	4.22	3.76	2.06	-1.07	1.44
Asian NIEs	1.78	1.67	5.67	-0.23	0.87
China	0.17	0.40	0.01	0.78	0.0
European Union	0.0	0.05	0.0	0.39	-0.0
FTA Excluding ASEAN 4					
United States	0.18	0.19	2.12	-0.04	0.18
Japan	1.32	1.19	6.64	-1.33	0.43
China	2.00	1.87	1.91	-0.36	0.57
Asian NIEs	2.87	2.67	7.61	-0.45	0.92
ASEAN 4	0.18	0.44	-0.06	0.72	-0.0
European Union	0.0	0.05	0.0	0.38	-0.0
FTA Excluding United States					
Japan	0.52	0.44	3.16	-0.84	0.23
China	1.77	1.60	1.80	-0.51	0.54
ASEAN 4	3.82	3.33	1.73	-1.14	1.33
Asian NIEs	1.57	1.46	4.79	-0.25	0.65
United States	0.0	0.05	-0.01	0.47	-0.0
European Union	0.0	0.03	-0.0	0.26	-0.0

Notes: *Real GDP* (C+I+G+E-M) provides a production-based measure of economic activity.
Real Absorption (C+I+G) provides a welfare measure based on economywide real final demand by households, government, and investment. Changes in this measure equal the *equivalent variation* for the economy, with changes in government consumption and investment valued according to private consumer's preferences.
Export/output share indicates the change in the aggregate export/output ratio for the economy.

Table 16: Trade Creation and Diversion for Alternative FTA Membership (Including Trade-Productivity Dynamic Linkages)

	Billion US$			Percentage change from base		
	Trade expansion	Trade creation	Trade diversion	Trade expansion	Trade creation	Trade diversion
Full Asian FTA						
United States	16.18	34.76	-18.59	2.81	21.26	-4.50
Japan	28.66	33.37	-4.71	7.04	14.43	-2.68
China	8.94	13.76	-4.82	6.30	17.92	-7.41
ASEAN 4	15.24	6.48	8.76	11.09	6.99	19.63
Asian NIEs	16.42	16.70	-0.28	6.42	10.71	-0.28
Total, FTA members	85.43	105.07	-19.63			
European Union	-0.27	-7.38	7.12	-0.04	-3.47	1.37
FTA Excluding China						
United States	14.69	36.71	-22.02	2.55	25.85	-5.07
Japan	25.04	30.11	-5.07	6.15	15.52	-2.38
ASEAN 4	13.63	6.17	7.45	9.92	7.35	13.95
Asian NIEs	13.31	13.89	-0.58	5.20	11.36	-0.43
Total, FTA members	66.66	86.88	-20.22			
China	0.15	-2.45	2.60	0.10	-3.20	4.00
European Union	-0.19	-6.73	6.54	-0.03	-3.53	1.21
FTA Excluding ASEAN 4						
United States	15.56	32.89	-17.33	2.70	22.48	-4.03
Japan	25.85	27.85	-2.00	6.35	13.84	-0.97
China	8.18	12.68	-4.50	5.77	17.91	-6.34
Asian NIEs	14.53	12.01	2.52	5.68	9.34	1.98
Total, FTA members	64.12	85.43	-21.31			
ASEAN 4	0.13	-2.74	2.86	0.09	-2.95	6.42
European Union	-0.16	-6.52	6.36	-0.02	-3.33	1.19
FTA Excluding United States						
Japan	12.76	13.64	-0.87	3.13	10.64	-0.31
China	7.53	15.62	-8.09	5.31	39.99	-7.88
ASEAN 4	12.43	7.38	5.05	9.04	11.18	7.07
Asian NIEs	10.02	15.56	-5.54	3.92	16.39	-3.45
Total, FTA members	42.74	52.20	-9.46			
United States	-0.36	-4.32	3.96	-0.06	-2.64	0.96
European Union	-0.20	-2.16	1.96	-0.03	-1.96	0.31

Notes: *Trade creation* is the increase in exports to *members of the FTA*; the trade creation figure for the European Union indicates the change in EU exports to FTA members.
Trade diversion is the increase in exports to *non-FTA members*, comprised of EU and rest of world.

by around 10 percent, with trade creation dropping by $3 billion with China out and $5.5 billion with ASEAN4 out. The biggest shift occurs when the US is excluded: the overall magnitude of trade expansion drops by more than half, and all of Japanese export growth occurs to markets within the FTA.

Regionalism versus Globalism: The Gains from Full Trade Liberalization

The experiments summarized thus far have contrasted the gains from a broad-based APEC FTA against those from a more narrow grouping where an APEC member is excluded. The results quite clearly suggest that there is an advantage to forming an APEC FTA that is as broad as possible. But one important question remains: how does the APEC FTA compare with the more liberal scenario in which global trade liberalization occurs, encompassing not only the APEC nations but the EU and economies in the rest of the world as well?

Table 17 summarizes the outcome from a simulation that incorporates such trade liberalization (and continuing to include the trade-productivity linkages). Compared to the Asian FTA, everyone gains: the EU is now able to achieve gains from trade liberalization, with a 0.2 percent GDP increase approximately equal to the U.S. gain. The outward-oriented Asian economies continue to benefit from increased access to deregulated export markets, with ASEAN4 growth rising by 1.1 percentage points and Chinese growth expanding by 0.8 percent. Among the developed economies, Japan gains the most, with a 0.3 percentage point GDP rise relative to the Asian FTA.

In the aggregate, the world is better off with global liberalization: GDP rises by $148 billion (without including any gain to for the rest of the world), and absorption by $140 billion, as compared to increases of only $112 billion in GDP and $103 billion in absorption in the APEC FTA scenario.

Table 17: World Trade Liberalization: Macro and Trade Performance (Including Trade-Productivity Dynamic Linkages)

	Percentage change from base				
	Real GDP	Real Absorption	Real exchange rate	Terms of trade	Export/ output share
United States	0.24	0.27	2.87	0.16	0.24
Japan	1.74	1.58	8.29	-1.55	0.59
China	2.92	2.76	2.79	-0.42	0.79
ASEAN 4	5.82	5.17	2.86	-1.27	1.96
Asian NIEs	3.31	3.21	8.68	-0.17	1.15
European Union	0.21	0.23	2.01	0.10	0.17

	Billion US$			Percentage change from base		
	Trade expansion	Trade creation	Trade diversion	Trade expansion	Trade creation	Trade diversion
United States	21.11	40.17	-19.07	3.66	12.69	-7.34
Japan	35.62	42.46	-6.84	8.75	13.89	-6.74
China	11.49	15.39	-3.90	8.11	13.93	-12.46
ASEAN 4	18.56	8.08	10.49	13.51	7.02	46.93
Asian NIEs	17.94	17.95	-0.01	7.01	9.03	-0.02
European Union	17.70	21.14	-3.43	2.42	9.92	-0.66
Total, FTA members	122.43	145.19	-22.76			

Notes: *Real GDP* (C+I+G+E-M) provides a production-based measure of economic activity.
Real Absorption (C+I+G) provides a welfare measure based on economywide real final demand by households, government, and investment. Changes in this measure equal the *equivalent variation* for the economy, with changes in government consumption and investment valued according to private consumer's preferences.
Export/output share indicates the change in the aggregate export/output ratio for the economy.
Trade expansion is the increase in total exports for each region.
Trade creation is the increase in exports to *members of the FTA*; the trade creation figure for the European Union indicates the change in EU exports to FTA members.
Trade diversion is the increase in exports to *non-FTA members*, comprised of EU and rest of world.

5. Conclusions

The simulations reported in this paper provide an assessment of the implications of an Asian FTA from several different perspectives. First, considering the impact of tariff and NTB elimination in a static, neoclassical experiment with no other changes, we find that the formation of an FTA is generally beneficial for its members, although the benefits range from quite small (for the US and China) to moderate (for the Asian NIEs). Trade creation exceeds trade diversion by a factor of four. While the

overall trade balance for each region is held constant, bilateral trade flows are substantially affected. ASEAN4 and China appear to have important complementarities in their export opportunities in the Asian FTA, with different sectoral and geographic patterns of export expansion.

Next, we consider the possible impact of possible linkages between improved trade performance and productivity. Including three different trade-productivity linkages, with relatively modest parameter choices, we find that the case for an Asian FTA is strengthened even further. All FTA members gain, and while the gains for the US are modest (around 0.2 percent of GDP), the gains for other members are quite substantial, exceeding 3 percent for ASEAN4 and the Asian NIEs..

We then consider the possibility that potential Asian FTA members might chose not to join, or be prevented from participating, through alternative simulations that exclude either China, ASEAN4, or the US from the FTA. The results are consistent: the excluded region suffers losses in GDP, absorption, consumption, and exports, while the members of the smaller FTA gain less than in the case of a broader FTA. These results suggest that, whatever, the political pressures that might exist, the *economic* justification for not joining (or excluding) potential FTA members is weak.

Finally, we contrast the Asian FTA outcome with more comprehensive global liberalization, and find that global liberalization continues to dominate regional arrangements: all APEC regions gain from broadening the FTA to include the European Union and rest of the world.

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Appendix: Structure of the APEC CGE Model

Solving the CGE Model

The CGE model presented here has been developed and solved using a package called the General Algebraic Modeling System (or GAMS). GAMS embodies two related developments of the last several years. First, the increasing power and availability of personal computers allows every modeler to have desktop access to computational resources that were once available only on mainframe computers. Second, the development of packaged software to solve complex mathematical or statistical problems such as that posed by our CGE model has permitted modelers to return their attention to economics.

Several syntax rules and presentation conventions are worth noting before continuing with a description of the model.[29] The main virtue of GAMS is it allows modelers to specify models in (nearly) standard algebraic notation, while leaving the actual solution to GAMS. For the most part, these rules and conventions correspond to standard algebraic practice, so that the modeler need not learn an entire new software "language" to use GAMS. Most of the departures from standard algebra are straightforward as well. "SUM" represents the summation operator, Σ; SUM(i,... means sum over the index i, while SUM((i,j),... means some over both i and j. "PROD" represents the product operator, π, and "LOG" is the natural logarithm operator. The "$" introduces a conditional "if" statement in an algebraic statement.[30] Parameters are treated as constants in the model; variables are free to vary endogenously, although some of them may be set exogenously as part of the model closure specification.[31]

Table 18 lists the regional, sectoral, and factor classifications used in the model, as well as identifying the sectoral subsets that are needed in the equations of the model. Table 19 contains the parameter definitions used in the CGE model equations. Table 20 contains the variables that appear in the model.

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[29] GAMS is designed to make complex mathematical models easier to construct and understand. In our case, we are using it to solve a large, fully-determined, non-linear CGE model (where the number of equations and number of variables are equal), although GAMS is suitable for solving linear, non-linear, or mixed integer programming problems as well. For a thorough introduction to model-building in GAMS, see Brooke, Kendrick, and Meeraus (1988).

[30] For example, PM(i,k,cty1)$imi(i,k,cty1) = xxx will carry out the expression shown for all PM(i,k,cty1) that belong to the set imi(i,k,cty1); in other words, calculate an import price for all sectors in which there are imports.

[31] For example, the exchange rate (EXR) and net foreign borrowing (FBAL) both are listed as variables; in practice, one will be set exogenously, while the other will be determined by the model.

Table 18: Regional, Sectoral and Factor Classifications in the APEC CGE Model

Countries and regions

CTY1, CTY2	Universe	USA	UNITED STATES
		EEC	EUROPEAN UNION
		JAP	JAPAN
		CHN	CHINA
		AS4	ASEAN 4
		NIE	ASIAN NIEs
		ROW	REST OF THE WORLD
K(CTY1)	Countries	USA	UNITED STATES
		EEC	EUROPEAN UNION
		JAP	JAPAN
		CHN	CHINA
		AS4	ASEAN 4
		NIE	ASIAN NIEs

Sectors and groupings

I,J	Sectors of production	GRAIN	GRAINS INCLUDING PROCESSED RICE
		OTHAG	OTHER AGRICULTURE
		FANDF	FORESTS AND FISHING
		MINES	ENERGY AND MINERALS
		FOOD	FOOD PROCESSING
		TEXT	TEXTILE APPAREL
		WOOD	WOOD AND PAPER
		INTER	BASIC INTERMEDIATES
		CAPGD	CAPITAL GOODS
		SERV	SERVICES

im(i,k)	Import sectors
imn(i,k)	Non-import sectors
ie(i,k)	Export sectors
ien(i,k)	Non-export sectors
imi(i,k,cty1)	Bilateral imports in base data
iei(i,k,cty1)	Bilateral exports in base data
ie1(i,k)	Aggregate CET export sectors
ied(i,k)	Downward sloping export demand from rest of world
iec(i,k)	Sectors with second level export CET
iecn(i,k)	Sectors with second-level competitive exports
ik(i)	Capital and intermediates goods sectors (INTER, CAPGD)
iag(i)	Agricultural sectors (GRAIN, OTHAG, FANDF)
iagn(i)	Non-agricultural sectors
iserv(i)	Service sector (for GDP accounts) (SERV)

Factors and groupings

iff,f	Factors of production	CAPITAL	Capital stock
		LAND	Agricultural land
		AGLAB	Rural agricultural labor
		INDLAB	Urban non-agricultural labor

Households and institutions

hh	Households	hhall	Single household category
ins	Institutions	labr	Labor
		ent	Enterprises
		prop	Property income

Table 19: Parameters in the APEC CGE Model

Basic model parameters	
CLES(i,hh,k)	Household consumption shares
E0(i,cty1,cty2)	Exports, base data
EK0(i,k)	Total sectoral exports, all destinations, base data
EKPTL0(k)	Aggregate exports, all destinations, base data
ENTR(k)	Enterprise income tax rate
ETAE2(i,k)	Externality elasticity for aggregate exports
ETAK2(i,k)	Externality elasticity for capital goods imports
ETAM2(k)	Externality elasticity intermediate inputs
FS0(iff,k)	Aggregate factor supply, base data
GLES(i,k)	Government expenditure shares
GOVGDP(k)	Government expenditure to GDP ratio
HHTR(hh,k)	Household income tax rate
INVGDP(k)	Investment to GDP ratio
IO(i,j,k)	Input-output coefficients
LSH(hh,k)	Household transfer income shares
MKPTL0(k)	Imports of capital goods, base data
PIE(i,k)	Ag. program producer incentive equivalent per unit
PVAB0(i,k)	Base-year value added price
PWE0(i,cty1,cty2)	World price of exports, base data
PWEFX0(i)	Benchmark world export price
PWM0(i,cty1,cty2)	World market price of imports, base data
PWTC(i,k)	Consumer price index weights (PQ)
RHSH(hh,k)	Household shares of remittance income
SINTYH(hh,ins,k)	Household distribution of value added income
SPREM(i,k)	Share of premium revenue to the government
TC(i,k)	Consumption tax rates
TE(i,k)	Tax rates on exports
THSH(hh,k)	Household transfer income shares
TM(i,k,cty1)	Tariff rates on imports
TX(i,k)	Indirect tax rates
VATR(i,k)	Value added tax rate
ZSHR(i,k)	Investment demand shares
Production and trade function parameters	
AC(i,k)	Armington function shift parameter
AD2(i,k)	CES production function shift parameter
AE(i,k)	CET export composition function shift parameter
ALPHA2(i,iff,k)	CES factor share parameter
AT(i,k)	CET function shift parameter
DELTA(i,k,cty1)	Armington function share parameter
ETAE(i,k)	Export demand elasticities for rest of world
ETAW(i)	Aggregate export demand elasticities for rest of world
GAMMA(i,k,cty1)	CET export composition function share parameters
GAMMAK(i,k)	CET function share parameter
RHOE(i,k)	CET export composition function exponent
RHOP(i,k)	CES production function exponent
RHOC(i,k)	Armington function exponent
RHOT(i,k)	CET function exponent
Parameters for AIDS import demand functions	
SMQ0(i,k,cty1)	Base year import value share
AQS(i,k)	Constant in Stone price index
AMQ(i,k,cty1)	Share parameter in AIDS function
AQ(i,k)	Constant in translog price index
BETAQ(i,k,cty1)	Coefficient in AIDS function

Table 20: Variables in the APEC CGE Model

Price block	
EXR(k)	Exchange rate
PC(i,k)	Consumption price of composite good
PD(i,k)	Domestic prices
PDA(i,k)	Processors actual domestic sales price including subsidy
PE(i,k,cty1)	Domestic price of exports
PEK(i,k)	Average domestic price of exports
PINDCON(k)	Consumer price index
PM(i,k,cty1)	Domestic price of imports
PQ(i,k)	Price of composite goods
PREM(i,k)	Premium income from import rationing
PVA(i,k)	Value added price including subsidies
PVAB(i,k)	Value added price net of subsidies
PWE(i,cty1,cty2)	World price of exports
PWM(i,cty1,cty2)	World price of imports
PWERAT(i,k)	Ratio of world export prices
PWEFX(i)	benchmark world export price
PX(i,k)	Average output price
TM2(i,k,cty1)	Import premium rates
Production block	
D(i,k)	Domestic sales of domestic output
E(i,cty1,cty2)	Bilateral exports
EK(i,k)	Aggregate sectoral exports
INT(i,k)	Intermediate demand
M(i,cty1,cty2)	Bilateral imports
Q(i,k)	Composite goods supply
SMQ(i,k,cty1)	Import value share in total sectoral demand
X(i,k)	Domestic output
Factor block	
AVWF(iff,k)	Average wage with current weights
FDSC(i,iff,k)	Factor demand by sector
FPE(k)	Total farm program expenditures
FS(iff,k)	Factor supply
FT(k)	Factor tax rate
WF(iff,k)	Average factor price
WFDIST(i,iff,k)	Factor differential
YFCTR(iff,k)	Factor income
Migration block	
WGDFL(la,k,lb,l)	Wage differentials
MIGL(la,k)	Labor migration flows (within category)
MIGRU(la,k)	Labor migration flows (across category)
Income and expenditure block	
CDD(i,k)	Private consumption demand
CONTAX(k)	Consumption taxes
ENTSAV(k)	Enterprise savings
ENTAX(k)	Enterprise taxes
ENTT(k)	Government transfers to enterprises
ESR(k)	Enterprise savings rate
EXPTAX(k)	Export tax revenue
FBAL(k)	Overall current account balance
FBOR(k)	Foreign borrowing by government
FKAP(k)	Foreign capital flow to enterprises
FSAV(k,cty1)	Bilateral net foreign savings
FSAVE(k)	Foreign savings
FTAX(k)	Factor taxes
GD(i,k)	Government demand by sector
GDPVA(k)	Nominal expenditure GDP
GDTOT(k)	Government real consumption
GOVSAV(k)	Government saving
GOVREV(k)	Government revenue
HHT(k)	Government transfers to households
HSAV(k)	Aggregate household savings
HTAX(k)	Household taxes
ID(i,k)	Investment demand (by sector of origin)
INDTAX(k)	Indirect tax revenue
MPS(hh,k)	Savings propensities by households
REMIT(k)	Remittance income to households
TARIFF(k,cty1)	Tariff revenue
VATAX(k)	Value added taxes
YH(hh,k)	Household income
YINST(ins,k)	Institutional income
ZFIX(k)	Fixed aggregate real investment
ZTOT(k)	Aggregate nominal investment
Externality effects	
SAD(i,k)	Aggregate exports externality parameter
SAD2(i,k)	Intermediate inputs externality parameter
SAC(iff,k)	Capital goods externality parameter
EKPTL(k)	Aggregate exports
MKPTL(k)	Capital goods imports

Table 21: Quantity Equations

(1)	X(i,k)	=	SAD(i,k)*SAD2(i,k)*AD2(i,k)*(SUM(iff,ALPHA2(i,iff,k)*FDSC(i,iff,k)**(-RHOP(i,k)))) **(-1/RHOP(i,k)) ;
(2)	(1-ft(k))*WF(iff,k)*WFDIST(i,iff,k)	=	1 - vatr(i,k))*pva(i,k)*SAD(i,k)*SAD2(i,k)*AD2(i,k) * (SUM(f, ALPHA2(i,f,k) *FDSC(i,f,k) **(-RHOP(i,k))))**((-1/RHOP(i,k))-1) *ALPHA2(i,iff,k)*FDSC(i,iff,k)**(-RHOP(i,k)-1) ;
(3)	INT(i,k)	=	SUM(j, IO(i,j,k)*X(j,k));

Model Specification

In addition to ten sectors for each country model, the model has four factors of production (two labor types, land, and capital), as identified in Table 18. The output-supply and input-demand equations are shown in Table 21. Output is produced according to a CES production function of the primary factors (equation 1), with intermediate inputs demanded in fixed proportions (equation 3). Producers are assumed to maximize profits, implying that each factor is demanded so that marginal product equals marginal cost (equation 2). In each economy, factors are not assumed to receive a uniform wage or "rental" (in the case of capital) across sectors; "factor market distortion" parameters (the WFDIST that appears in equation 2) are imposed that fix the ratio of the sectoral return to a factor relative to the economywide average return for that factor.

Table 22: Price Equations

(4)	PM(imi,k,cty1)	=	PWM(imi,k,cty1)*EXR(k) * (1 + TM(imi,k,cty1) + tm2(imi,k,cty1)) ;
(5)	PE(iei,k,cty1)	=	PWE(iei,k,cty1) * (1 - te(iei,k))*EXR(k) ;
(6)	PEK(ie,k)	=	SUM(cty1$pt(k,cty1), PE(i,k,cty1) * E(i,k,cty1)) / EK(i,k) ;
(7)	PDA(i,k)	=	(1 - TX(i,k)) * PD(i,k) ;
(8)	PQ(i,k)*Q(i,k)	=	PD(i,k)*D(i,k) + SUM(cty1$imi(i,k,cty1), (PM(i,k,cty1)*M(i,k,cty1))) ;
(9)	PX(i,k)*X(i,k)	=	PDA(i,k)*D(i,k) + SUM(cty1$iei(i,k,cty1), (PE(i,k,cty1)*E(i,k,cty1))) ;
(10)	PC(i,k)	=	PQ(i,k) * (1 + TC(i,k)) ;
(11)	PINDCON(k)	=	PROD(i, PC(i,k)**pwtc(i,k)) ;
(12)	PVA(i,k)	=	PX(i,k) - SUM(j,IO(j,i,k)*PC(j,k)) + PIE(i,k);
(13)	PWE(i.cty1,cty2)	=	pwm(i,cty2.cty1) ;

The price equations are shown in Table 22. In equations 4 and 5, world prices are converted into domestic currency, including any tax or tariff components. Equation 13 guarantees cross-trade price consistency, so that the world price of country A's exports to country B are the same as the world price of country B's imports from country A. Equation 6 defines the aggregate export price as the weighted sum of the export price to each destination. Equation 7 calculates the domestic price, net of indirect tax. Equations 8 and 9 describe the prices for the composite commodities Q and X. Q represents the aggregation of sectoral imports (M) and domestic goods supplied to the domestic market (D). X is total sectoral output, which is a CET aggregation of total supply to export markets (E) and goods sold on the domestic market (D). Equation 10 defines the consumption price of composite goods from the composite good price (PQ) and consumption taxes (tc). Equation 12 defines the sectoral price of value added, or

"net" price (PVA), as the output price minus the unit cost of intermediate inputs (from the input-output coefficients), plus production incentives from exogenous agricultural producer subsidy schemes (PIE).

In the APEC CGE model, the aggregate consumer price index in each region is set exogenously (PINDCON in equation 11), defining the *numeraire*. The advantage of this choice is that solution wages and incomes are in real terms; moreover, since our Cobb-Douglas price index is consistent with the underlying Cobb-Douglas utility function, the changes in consumption levels generated by the model are exactly equal to the *equivalent variation*. The solution exchange rates in the sub-regions are also in real terms, and can be seen as equilibrium price-level-deflated (PLD) exchange rates, using the country consumer price indices as deflators.

The circular flow of income from producers, through factor payments, to households, government, and investors, and finally back to demand for goods in product markets is shown in the equations in Table 23. The country models incorporate official tariff revenue (TARIFF in equation 15) which flows to the government, and the tariff equivalent of non-tariff barriers (PREM in equation 16) which accrues as rents to the private sector.[32] Each economy is modelled as having a number of domestic market distortions, including sectorally differentiated indirect, consumption, and value-added taxes as well as factor, household, and corporate income taxes (equations 17-18 and 23-27). The single household category in each economy has a Cobb-Douglas expenditure functions (equation 35). Real investment and government consumption are set in equations 36 and 37, while aggregate government consumption and investment are set to fixed shares of GDP in equations 39 and 40.

[32] Because the GTAP data source used combines tariffs and NTBs together, in the APEC model data both tariffs and NTBs are treated as tariffs (TM) only, except for the additional NTBs on industrial goods for Japan, which are kept as separate NTBs (TM2).

Table 23: Income and Expenditure Equations

(14)	YFCTR(iff,k)	=	SUM(i, (1-ft(k))*WF(iff,k)*WFDIST(i,iff,k)*FDSC(i,iff,k));
(15)	TARIFF(k,cty1)	=	SUM(i$imi(i,k,cty1), TM(i,k,cty1)*M(i,k,cty1)*PWM(i,k,cty1))*EXR(k) ;
(16)	PREM(i,k)	=	SUM(cty1$imi(i,k,cty1), TM2(i,k,cty1)*M(i,k,cty1)*PWM(i,k,cty1))*EXR(k) ;
(17)	INDTAX(k)	=	SUM(i, TX(i,k)*PD(i,k)*D(i,k)) ;
(18)	EXPTAX(k)	=	SUM((i,cty1), te(i,k)*PWE(i,k,cty1)*E(i,k,cty1)*EXR(k)) ;
(19)	YINST("labr",k)	=	SUM(la, YFCTR(la,k)) ;
(20)	YINST("ent",k)	=	YFCTR("capital",k) + EXR(k)*FKAP(k) - ENTSAV(k) - ENTAX(k) + ENTT(k) + SUM(i,(1-sprem(i,k))*PREM(i,k)) ;
(21)	YINST("prop",k)	=	YFCTR("land",k) ;
(22)	YH(hh,k)	=	SUM(ins, sintyh(hh,ins,k)*YINST(ins,k)) + rhsh(hh,k)*EXR(k)*REMIT(k) + HHT(k)*thsh(hh,k) ;
(23)	ENTAX(k)	=	ENTR(k)*(YFCTR("capital",k) + ENTT(k)) ;
(24)	FTAX(k)	=	SUM((iff,i), ft(k)*WF(iff,k)*WFDIST(i,iff,k)*FDSC(i,iff,k));
(25)	HTAX(k)	=	SUM(hh, hhtr(hh,k)*YH(hh,k)) ;
(26)	VATAX(k)	=	SUM(i, vatr(i,k)*PVA(i,k)*X(i,k)) ;
(27)	CONTAX(k)	=	SUM(i, TC(i,k)*PQ(i,k)*Q(i,k)) ;
(28)	FPE(k)	=	SUM(i, pie(i,k)*X(i,k)) ;
(29)	GOVREV(k)	=	SUM(cty1, TARIFF(k,cty1)) + INDTAX(k) + EXPTAX(k) + FTAX(k) + HTAX(k) + CONTAX(k) + SUM(i,sprem(i,k)*PREM(i,k)) + ENTAX(k) + VATAX(k) + FBOR(k)*EXR(k);
(30)	GOVSAV(k)	=	GOVREV(k) - SUM(i, GD(i,k)*PC(i,k)) - HHT(k) - ENTT(k) - FPE(k) ;
(31)	HSAV(k)	=	SUM(hh, MPS(hh,k)* ((1.0-hhtr(hh,k))*YH(hh,k)));
(32)	ENTSAV(k)	=	esr(k)*YFCTR("capital",k) ;
(33)	ZTOT(k)	=	GOVSAV(k) + HSAV(k) + ENTSAV(k) + EXR(k) * FSAVE(k);
(34)	FSAVE(k)	=	FBAL(k)-FKAP(k)-FBOR(k)-REMIT(k) ;
(35)	CDD(i,k)	=	SUM(hh, CLES(i,hh,k)*YH(hh,k)*(1.0-hhtr(hh,k))*(1.0-mps(hh,k))) / PC(i,k) ;
(36)	GD(i,k)	=	gles(i,k)*GDTOT(k) ;
(37)	ID(i,k)	=	zshr(i,k)*ZFIX(k) ;
(38)	ZTOT(k)	=	SUM(i, PC(i.k)*ID(i,k)) ;
(39)	GOVGDP(k)	=	SUM(i, pc(i,k)*gd(i,k)) / gdpva(k) ;
(40)	INVGDP(k)	=	SUM(i, pc(i,k)*id(i,k)) / gdpva(k) ;
(41)	GDPVA(k)	=	SUM(i, PC(i,k)* (CDD(i,k)+GD(i,k)+ID(i,k))) + SUM((i,cty1), PWE(i,k,cty1) * E(i,k,cty1))*EXR(k) - SUM((i,cty1), PWM(i,k,cty1) * M(i,k,cty1))*EXR(k) ;

Export-related functions are shown in Table 24. Exports are supplied according to a CET function between domestic sales and total exports (equation 42), and allocation between export and domestic markets occurs in order to maximize revenue from total sales (equation 44). The rest of the world is modeled as a large supplier of imports to each model region at fixed world prices. Rest of world demand for regional exports can either be modelled as occurring at fixed world prices, or with two alternative mechanisms to capture possible terms of trade effects. First, each region can be characterized as facing its own downward-sloping demand curve based on its total exports (equation 47), where the price it faces is a function of the amount it exports relative to the base. Second, one can characterize the export price for each region as determined by aggregated changes in the export market, so that the average world price is set in equation 48, and each region's export price linked to that in equation 49 by

Table 24: Export and Externality Equations

(42)	X(ie1,k)	=	AT(ie1,k)*(GAMMAK(ie1,k)*EK(ie1,k)**(-RHOT(ie1,k)) + (1 - GAMMAK(ie1,k))*D(ie1,k) **(-RHOT(ie1,k)))**(-1/RHOT(ie1,k)) ;
(43)	X(ien,k)	=	D(ien,k) ;
(44)	EK(ie1,k)	=	D(ie1,k)*(PDA(ie1,k)/PEK(ie1,k)*GAMMAK(ie1,k)/(1-GAMMAK(ie1,k))) **(1/(1+RHOT(ie1,k)));
(45)	E(iec,k,cty1)	=	EK(iec,k) * (((gamma(iec,k,cty1)*PEK(iec,k)) / (ae(iec,k)**rhoe(iec,k) * pe(iec,k,cty1))) **(1/(1+rhoe(iec,k)))) ;
(46)	PE(iecn,k,cty1)	=	PEK(iecn,k) ;
(47)	EK(i,k,"row")	=	EK0(i,k,"row")* (PWE(i,k,"row")/PWE0(i,k,"row"))**(-etae(i,k)) ;
(48)	SUM(k, E(i,k,"row"))	=	SUM(l. E0(i,l,"row")) * (PWEFX(i)/PWEFX0(i))**(-etaw(i)) ;
(49)	PWE(i,k,"row")	=	PWERAT(i,k)*PWEFX(i) ;
(50)	M(i,cty1,cty2)	=	E(i,cty2,cty1) ;
(51)	SAD2(i,k)	=	(mkptl(k)/mkptl0(k))**etam2(k))*(1 - pvab0(i,k)) + pvab0(i,k) + SLACKAD2(i,k);
(52)	SAD(ie1,k)	=	(EK(ie1,k)/EK0(ie1,k))**(etae2(ie1,k)) + SLACKAD(ie1,k) ;
(53)	SAC("capital",k)	=	(EKPTL(k)/EKPTL0(k))**etak2(k) + SLACKAC("capital",k) ;
(54)	EKPTL(k)	=	SUM((cty1,i), PWE(i,k,cty1)*E(i,k,cty1)) ;
(55)	MKPTL(k)	=	SUM((cty1,ik), PWM0(ik,k,cty1)*M(ik,k,cty1)) ;

requiring that PWERAT equal 1. The final equations in Table 24 specify how trade-related externalities are incorporated into the model. There are three different kinds of trade-productivity links. Equation 51 relates productivity in production to imports of intermediate and capital goods. The extent of productivity increase depends on the share of intermediates in production. The productivity parameter, SAD2, appears in the production function and profit maximization equations (1 and 2). Equation 52 quantifies the externality associated with export performance — higher export growth relative to the base value at the sectoral level (EK/EK0) translates into a larger value of the productivity parameter SAD, which also directly affects domestic productivity (equations 1 and 2). Equation 53 represents the externality associated with aggregate exports. Increased aggregate exports yields a higher value of SAC, which is "embodied" in the capital stock input into the production process.

Table 25: AIDS Import Demand Equations

(56)	PM(i,k,k)	=	PD(i,k) ;
(57)	LOG(PQ(i,k))	=	AQ(i,k) + SUM(cty2, AMQ(i,k,cty2)*LOG(PM(i,k,cty2))) + (1/2)*SUM((cty1,cty2), GAMMAQ(i,k,cty1,cty2)*LOG(PM(i,k,cty1)) * LOG(PM(i,k,cty2))) ;
(58)	SMQ(imi,k,cty1)	=	AMQ(imi,k,cty1) + BETAQ(imi,k,cty1)*LOG(Q(imi,k)) + SUM(cty2,GAMMAQ(imi,k,cty1,cty2)*LOG(PM(imi,k,cty2))) ;
(59)	SMQ(i,k,k)	=	1 - SUM(cty1, SMQ(i,k,cty1)) ;
(60)	M(i,k,cty1)	=	smq(i,k,cty1)*PQ(i,k)*Q(i,k) / PM(i,k,cty1) ;
(61)	PD(i,k) * D(i,k)	=	SMQ(i,k,k) * Q(i,k)*PQ(i,k) ;

The specification of the almost ideal demand system (or AIDS) for imports is shown in Table 25. The expenditure shares SMQ are given by equation 58, where subscript *imi* refers to sectors, subscript *k* refers to the importing country, and subscript *cty1* refers to the source of the imports (another region

or the rest of the world). We adopt the notation convention that when $k = cty1$, we are describing the domestic component of composite demand (D). Hence in equation 56, the "own" price of imports is simply the domestic price, and in equation 61, D is determined by the $SMQ_{i,k,k}$ share, while the import demands are determined in equation 60. The composite price index, PQ, is defined in equation 57 as a translog price index [Deaton and Muellbauer (1980)].[33]

Table 26: Migration Relations

(62)	(AVWF(la,k)/EXR(k))	=	wgdfl(la,k,la,l)*(AVWF(la,l)/EXR(l)) ;
(63)	FS(la,k)	=	FS0(la,k) + MIGL(la,k) + MIGRU(la,k) ;
(64)	SUM(k, MIGL(la,k))	=	0 ;
(65)	SUM(la, MIGRU(la,k))	=	0 ;

Table 26 outlines the labor migration relations in the model (which are not used in the simulations reported in this paper), equilibrium international migration levels are determined which maintain a specified ratio of real wages in the two labor categories in the countries, measured in a common currency. According to equation 62, the international migration equilibrium requires that real average wages (AVWF) remain in a fixed ratio (WGDFL) for each migrating labor category in the two countries, measured in a common currency. Similarly, internal migration in each country maintains a specified ratio of average real wages between the rural and unskilled urban markets (the EXR terms become irrelevant). Domestic labor supply in each skill category in each country is then adjusted by the migrant labor flow (equation 63), while the other two equations insure that workers do not "disappear" or get "created" in the migration process.

Table 27: Market-Clearing Equations

(66)	Q(i,k)	=	INT(i,k) + CDD(i,k) + GD(i,k) + ID(i,k) ;
(67)	FS(iff,k)	=	SUM(i, FDSC(i,iff,k)) / SAC(iff,k) ;
(68)	AVWF(iff,k)	=	SUM(i, (1-ft(k))*wfdist(i,iff,k)*wf(iff,k)*fdsc(i,iff,k))/SUM(j, fdsc(j,iff,k)) ;
(69)	FSAV(k,cty1)	=	SUM(i, PWM(i,k,cty1)*M(i,k,cty1)) - SUM(i, PWE(i,k,cty1)*E(i,k,cty1)) ;
(70)	FBAL(k)	=	SUM(cty1, FSAV(k,cty1)) ;

To complete the model, there are a number of additional "market-clearing" or equilibrium conditions that must be satisfied, as shown in Table 27. Equation 66 is the material balance equation for each sector, requiring that total composite supply (Q) equal the sum of composite demands. Equation 67 provides equilibrium in each factor market; the SAC parameter provides the means to incorporate the externality associated foreign capital goods imports. Equation 69 is the balance condition in the foreign exchange market, requiring that import expenditures equal the sum of export earnings and net foreign capital inflows; equation 70 is the overall trade balance equation, summing up the bilateral trade balances.

[33] Robinson, Soule, and Weyerbrock (1991) analyze the empirical properties of different import aggregation functions in a three-country model of the U.S., European Community, and rest of world that is broadly similar to our APEC CGE model. Green and Alston (1990) discuss the computation of various elasticities in the AIDS system when using the Stone or translog price indices.

Model Closure

The APEC model permits a number of different "closure" choices that affect the macroeconomic relationships in the model. In all simulations reported in this paper, we have assumed that the aggregate trade balance (FBAL) is fixed for each country, and that the exchange rate (EXR) varies to achieve external balance. Fixed investment and government consumption shares in GDP (GOVGDP and INVGDP) are also fixed exogenously in equations 39 and 40. To satisfy the government budget constraint in equation 30, we permit lump-sum household transfers (HHT) to be determined as a residual. Since investment is fixed as a share of GDP, some component of aggregate savings must be free to move; we require that household savings rates (MPS) adjust to achieve savings-investment balance.

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